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COUNTY BOROUGH OF SWANSEA

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OF THE
OPENING

MAIN DRAINAGE WORKS

30th JULY, 1936

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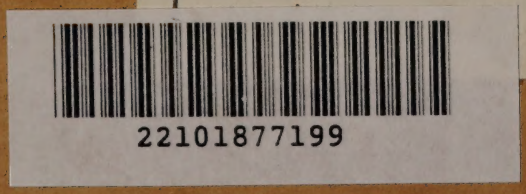
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COUNTY BOROUGH OF SWANSEA

OPENING

OF

MAIN DRAINAGE WORKS

ON THURSDAY,
30th JULY, 1936

BY

Mr. Alderman Edward Harris
Chairman of the Sewerage and Drainage Committee.

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HIS WORSHIP THE MAYOR, COUNCILLOR A. R. BALL, J.P.

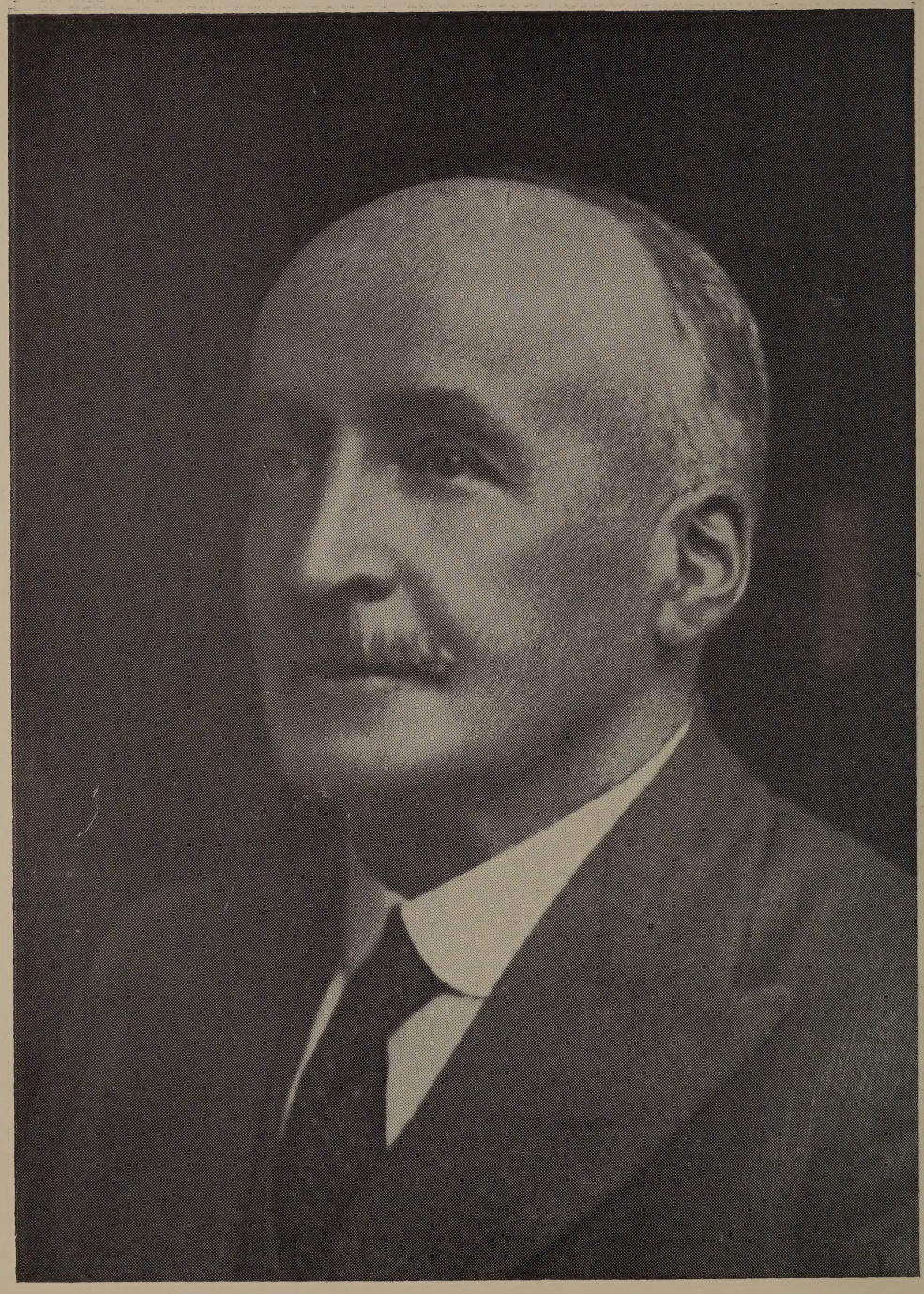


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ALDERMAN EDWARD HARRIS

Chairman of the Sewerage and Drainage Committee

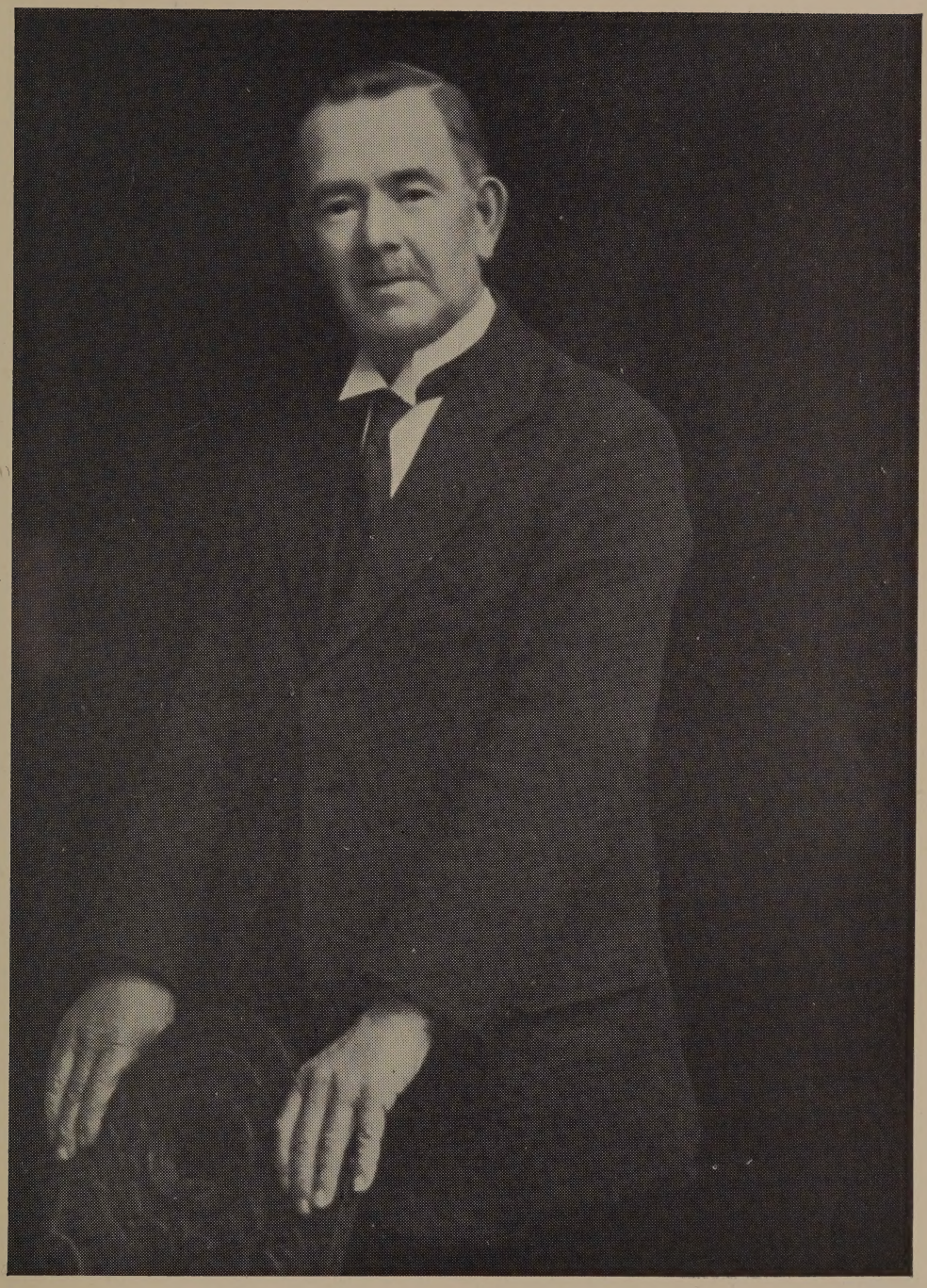


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ALDERMAN DANIEL EVANS, J.P.
Vice-Chairman, Sewerage and Drainage Committee.

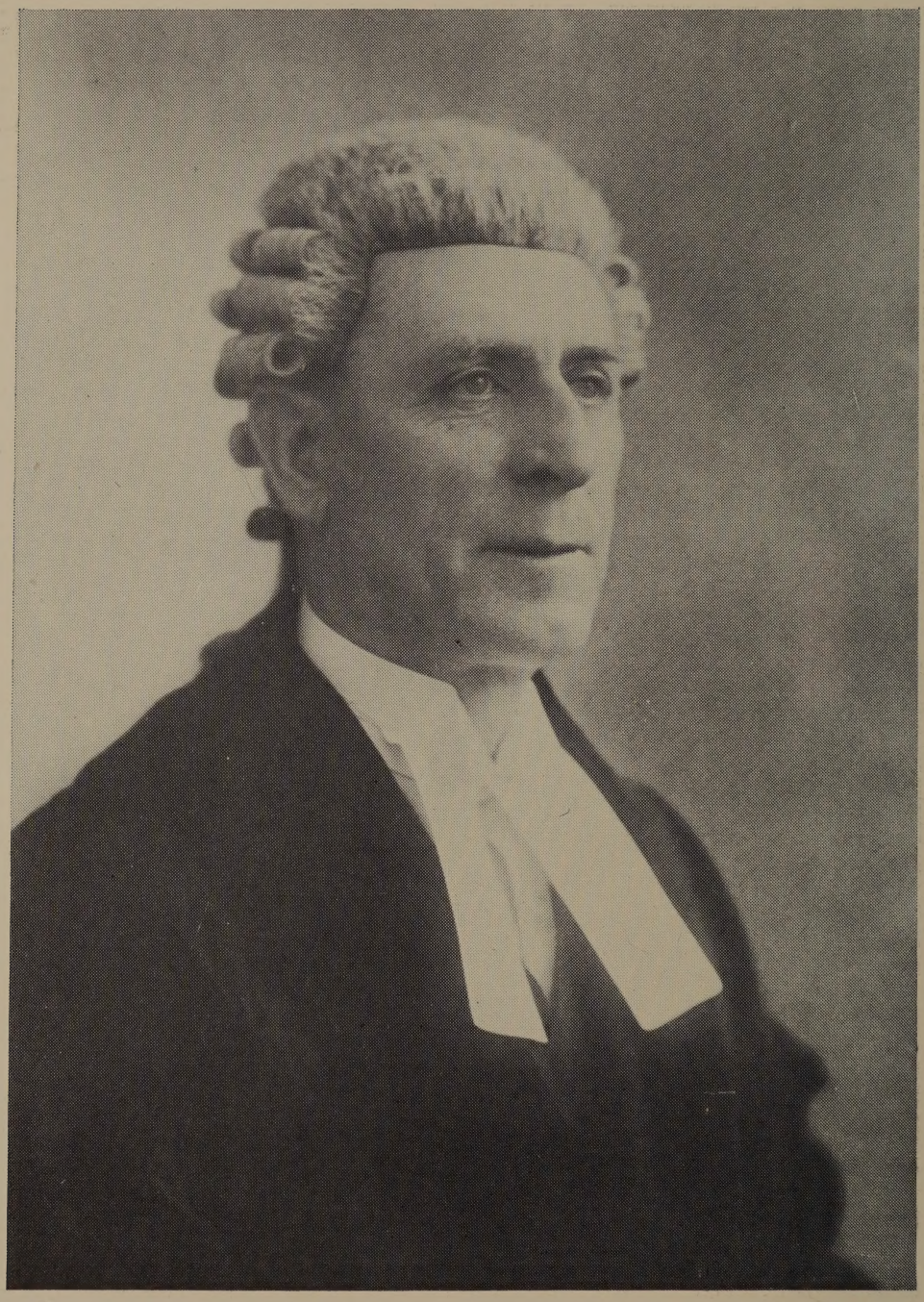


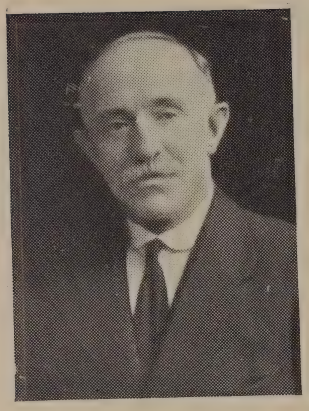
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H. L. LANG-COATH, Esq.,
Town Clerk

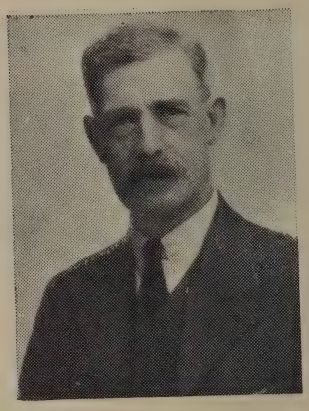


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J. R. HEATH, Esq., M.Inst.M. & Cy.E.
Chief Engineer, Main Drainage Scheme



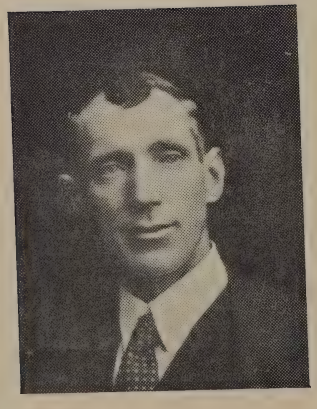
Alderman G. H. Hollett



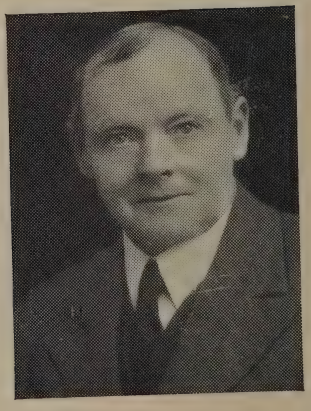
Alderman H. E. Thomas, J.P.



His Worship the Mayor
Councillor A. R. Ball, J.P.



Councillor T. W. Allison



Councillor J. R. Martin

MEMBERS OF THE SEWERAGE AND DRAINAGE COMMITTEE NOT INCLUDED IN GROUP PHOTOGRAPH

Photos by Chapman



SEWERAGE AND DRAINAGE COMMITTEE AND OFFICIALS

Standing :—D. J. M. Davies (*M.D. Dept.*); Coun. A. Abberfield; Coun. D. Jones; Ald. W. D. Rees; Coun. W. Harries, J.P.; F. B. Norton (*T.C. Dept.*); Coun. D. J. Fisher; Coun. T. Evans; E. V. Bevan (*M.D. Dept.*).
Coun. Mrs. E. Rosser, J.P.

Seated :—Ald. D. Williams, J.P., M.P.: J. R. Heath (*Chief Engineer*); Ald. Dl. Evans, J.P. (*Vice-Chairman*); Ald. Edward Harris (*Chairman*); H. L. Lang-Coath (*Town Clerk*); Coun. D. J. Davies, J.P.; Coun. R. Roberts

COUNTY BOROUGH OF SWANSEA.

HIS WORSHIP THE MAYOR, Councillor A. R. BALL, J.P.

SEWERAGE AND DRAINAGE COMMITTEE :

Chairman :
Alderman EDWARD HARRIS.

Vice-Chairman :
Alderman DANIEL EVANS, J.P.

Alderman G. H. HOLLETT.
Alderman H. E. THOMAS, J.P.
Alderman Dd. WILLIAMS, J.P., M.P.
Councillor A. ABBERFIELD.
Councillor T. W. ALLISON.
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Councillor W. HARRIES, J.P.
Councillor D. JONES.
Councillor J. R. MARTIN.
Councillor R. ROBERTS.
Councillor Mrs. E. ROSSER, J.P.

H. L. LANG-COATH, *Town Clerk.*

J. RICHARD HEATH, *Borough Engineer and Surveyor & Chief Engineer of the Swansea Main Drainage Scheme.*

COUNTY BOROUGH OF SWANSEA.

SEWERAGE OF SWANSEA.

FOR many years prior to the year 1918 the area of the County Borough of Swansea had remained at 6,229 acres, and comprised generally, in addition to the town and docks areas on the coastal strip between Brynmill and Port Tennant, that portion of the Swansea Valley extending up to Morriston and Llansamlet. During that period the main town portion of Swansea and the neighbourhoods on both sides of the River Tawe near its mouth, had undergone considerable expansion, and at the same time growths in population further up the valley had taken place in fairly well defined areas in the localities adjacent to the centres of industrial development, giving rise to the subsidiary townships of Cwmbwrla, Manselton, Landore, Brynhyfryd, Treboeth, Morriston, and Llansamlet.

As these communities grew, it devolved upon the Town Council, acting as the Urban Sanitary Authority, to make provision for their drainage and other sanitary needs.

The original sewers for the town area of Swansea were laid in the year 1854, when the population of this area was about 30,000. The main town sewer was laid following, generally, the course of the old "Town Ditch," with an outfall into the River Tawe near Pier Street. At later dates the districts of Landore and Morriston were provided with drainage systems, having separate outfalls into the tidal waters of the River Tawe, whilst the portions of the borough situate on the east bank of the river, near its mouth, came to be drained to two separate outfalls, one into the river at the New Cut and the other into Swansea Bay at Port Tennant.

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These sewers were on the " combined " system, and as building development increased in the districts served by them, coupled with the increased flow of sewage per head of population—due principally to the more universal adoption of baths and sanitary fittings in dwelling houses —it became apparent that the sewers were in many districts overloaded, and serious floodings occurred in consequence.

With the continued expansion of the built-up areas, more frequent floodings took place, and various measures were taken from time to time to relieve the sewers of storm-water. One such measure which was of considerable importance was the construction in 1895 of a 6ft. diameter sewer in Somerset Place, having a separate outfall to the River Tawe, which in addition to relieving the Strand sewer, was later extended as a 5ft. diameter sewer to Union Street, relieving at several points the existing town sewers. Swansea town was extending westwards, and rapid development was taking place in most of the other districts, particularly those in the Cwmbwrla, Gendros and Manselton districts, which drained to the town sewers.

Arising out of the increasing state of sewage pollution of the River Tawe running through the densely populated areas in the Swansea Valley and discharging into Swansea Bay, it became apparent that something would have to be done to deal on comprehensive lines with the drainage of the Borough. Investigations of the problem proceeded over a period of about 25 years, during which the following schemes were considered :—

BRYNMILL FORESHORE SCHEME.—In 1890 the then Borough Engineer (the late Mr. Wyrill) was instructed to prepare a scheme for a new main sewer outfall on the foreshore of the Swansea Bay at Brynmill, discharging at low water. Following a Local Government Board Inquiry, this scheme was considered unsuitable.

SWANSEA PIER HEAD SCHEME.—A proposal to construct a new outfall sewer to discharge at the Swansea Pier Head was put forward by Mr. Wyrill, and was favourably reported upon in 1907 by Mr. Chatterton, whom the Town Council called in to advise them. The Council, after careful consideration, decided not to adopt this scheme, the principal objection to it being that it did not deal on sufficiently comprehensive lines with the future needs of the Borough.

MUMBLES HEAD SCHEME.—The possibility of carrying a main outfall sewer to discharge into the true current of the Bristol Channel at Mumbles Head was investigated by Mr. Wyrill, and reported upon by him in 1907. No action was taken on this report until the year 1911, when he was instructed to prepare a comprehensive scheme for the drainage of the whole Borough. The population by this time had increased to 114,663.

In 1912 Parliamentary powers were sought for carrying out this scheme, but these powers were not then granted, and it was decided to proceed with certain amendments to this scheme.

BOROUGH EXTENSION AND MAIN DRAINAGE SCHEME

In the years immediately preceding the War which broke out in 1914, the population had shewn considerable further increase, and a considerable percentage of the population whose business and commercial activities were carried on within the borough, were living in areas immediately outside the borough boundary. The population had by now increased to about 120,000. It was felt that the time was ripe when the then borough boundary should be extended, and accordingly in 1915 the Town Council embarked upon a bold scheme of borough extension.

The question of a sewerage system adequate to deal with the needs of the proposed enlarged borough became one of the major issues before the Town Council. It was therefore decided to incorporate a Main Drainage Scheme on comprehensive lines, with an outfall at Mumbles Head, an as integral part of the proposals under the Borough Extension

Scheme, and Mr. Wyrill, the then Borough Engineer, was instructed to prepare a drainage scheme on these lines in collaboration with the late Mr. Midgeley Taylor, whom the Corporation engaged as Consulting Engineer for this purpose.

A Local Government Board Inquiry into the Corporation's application for an extension of the borough boundary, which proposal also included the Main Drainage Scheme, was held in 1915, and the Borough Extension Scheme was sanctioned by the Government under the Local Government Board's Provisional Order Confirmation (No. 6) Act 1918. The areas thus added to the borough were the whole of the Urban District of Oystermouth, the parish of Brynau (in the Gower Rural District), the parish of Cockett, parts of the parishes of Penderry and Clase Rural, and the parish of Llansamlet (all in the Swansea Rural District). With the exception of the Mumbles, West Cross and Sketty districts, the whole of these added areas were at that time unsewered.

The borough was thus increased in area from 6,229 acres to 24,241 acres, and the total population brought up to about 150,000.

Subsequently the population of the enlarged borough increased by the year 1921 to 157,554, and by the year 1931 to 164,825. The estimated population of the borough in July, 1935, was 165,550.

The granting of the Borough Extension Scheme of 1918 imposed upon the Corporation the obligation, amongst other things, of commencing the construction, in accordance with plans to be approved by the then Local Government Board, of the Main Trunk Sewer for the disposal of the sewage of the Borough "within six months from the date on which the Local Government Board may sanction the borrowing of moneys to defray the expenses of such work or within such further period as the Local Government Board may authorise."

Owing, however, to the continuation of the War to near the end of 1918, and to the exceptionally high costs of labour and materials which prevailed for a considerable time in the post-war period, the Government

allowed the Corporation to defer the commencement of the main trunk sewer until more reasonable prices prevailed. The remarkable extent of building development which, however—under the stimulus of the benefits derived from inclusion in the borough, coupled with the building subsidies given by the Government—took place in the immediate post-war years, particularly in the added areas, made the question of providing adequate sewerage facilities for these areas of very pressing importance.

Accordingly a comprehensive programme of sewerage works catering for the drainage of the whole borough, as enlarged, was prepared and approved by the Council. Under this programme the sequence of districts was arranged in which the various portions of the works should proceed, precedence being given to those districts where the need was most pressing, compatible with suitable outfalls being available. Thus the Main Drainage Scheme came into being, the works involved falling under two main divisions as follows :—

PART I.—The MAIN TRUNK (INTERCEPTING) SEWER from Mumbles Head—where it would have an outfall beyond the light-house into the true current of the Bristol Channel—around the shore of Swansea Bay to Swansea town, and thence along the Swansea Valley to a point at Clydach just beyond the borough boundary, a distance of about 11½ miles, together with incidental works. At selected points along the route quantities up to six times the dry weather flow of sewage would be intercepted by the Trunk Sewer, storm-water in excess thereof passing on to discharge through existing outlets.

PART II.—SUBSIDIARY (OR DISTRICT) SEWERS to drain the outlying and unsewered areas added to the Borough in 1918, together with the unsewered areas within the limits of the old borough. These proposals visualised the construction of some 40 miles of new sewers, and the connection of the same to the Main Trunk Sewer gravitating to Mumbles Head.

Low-lying districts on the seaboard, in the Swansea Valley and beyond the eastern and western watersheds thereof dictated the necessity of providing each of ten areas with a pumping station to raise the sewage to the Main Trunk Sewer.

The foregoing scheme thus visualised the disposal of the whole of the sewage of the borough at the Mumbles Head sea outfall.

In the year 1922 unemployment became very prevalent, and local authorities were invited by the Government to put in hand suitable works of public utility as Distress Works to which the Unemployment Grants Committee were prepared to make grants-in-aid.

As works of sewerage and drainage are particularly suitable for the employment of a good percentage of unskilled labour, the Corporation decided to put forward, in response to the Government's request, instalments of the Main Drainage Scheme, a start being made with the Subsidiary sewers in the unsewered districts most urgently requiring attention. Applications for approval and loan sanctions were submitted to the Ministry of Health in respect of several groups of these sewers, and consents to proceed were duly given. This step marked the active commencement of the programme of works under the Main Drainage Scheme.

In the meantime the Council appointed a separate Committee, viz., the Sewerage and Drainage Committee, to investigate and advise them upon the full import of the obligations of the Main Drainage Scheme, and to take the requisite steps so as to be in a position to proceed with the same when the time became opportune or when called upon by the Government to do so.

The magnitude of the task to be undertaken was so great that a separate administration in the form of a Main Drainage Department was created. Mr. J. R. Heath, the Council's Borough Engineer and Surveyor, was appointed Chief Engineer of the Main Drainage Scheme, and provided

with an engineering staff, the new department being controlled by the Sewerage and Drainage Committee. This administration proceeded with the work of preparing the Main Drainage Scheme in detail, whilst at the same time it had to carry into execution and complete certain groups of the Subsidiary Sewers (which were authorised by the Council) in advance of the more important and ultimately indispensable feature of the scheme, viz., the Main Trunk Sewer and sea outfall at Mumbles Head. Several large groups of the Subsidiary sewers were accordingly carried out between the years 1922 and 1931 as instalments of the whole scheme.

Under a modification introduced into the scheme, the districts of Cockett, Fforestfach and Waunarlwydd are drained to the Loughor Estuary, but otherwise the whole of the Borough will be drained to Mumbles Head.

In the year 1929, unemployment in the country had become very acute, and the Government then invited local authorities to put forward such schemes of public utility as would employ the largest numbers of workpeople, with the object of relieving unemployment; grants-in-aid were offered towards the cost of schemes which would be regarded, after investigation by the Unemployment Grants Committee, as being suitable for the purpose.

The Council represented that the hitherto deferred portions of the Main Drainage Scheme, comprising as it did the major works in the form of the Main Trunk Sewer, Storage Tanks and Sea Outfall, as well as large and important groups of Subsidiary sewers for the unsewered districts, were eminently suitable as unemployment relief works, and submitted for the consideration of the Unemployment Grants Committee the large programme of sewerage works thus involved. This programme was accepted as being suitable to qualify for the Government grant, and the Corporation received approval of the programme and sanction to proceed with the works on condition that the same were actively commenced by the 1st October, 1931, and completed within five years of commencement. (The date of commencement was later amended to 8th December, 1931.)

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The programme of works now to be accelerated was therefore drawn up in groups, and assigned for construction by contracts and direct administration as follows :—

PART I.—MAIN TRUNK SEWER.

Contract No. 8—Mumbles Head to Brynmill—length approx. 4½ miles.

Contract No. 9—Brynmill to Clydach—length approx. 7 miles.

PART II.—SUBSIDIARY SEWERS.

Contract No. 10—Langland Bay, Newton and Sketty to Brynmill.

Contract No. 11—Derwen Fawr, Clyne Valley, Killay and Dunvant.

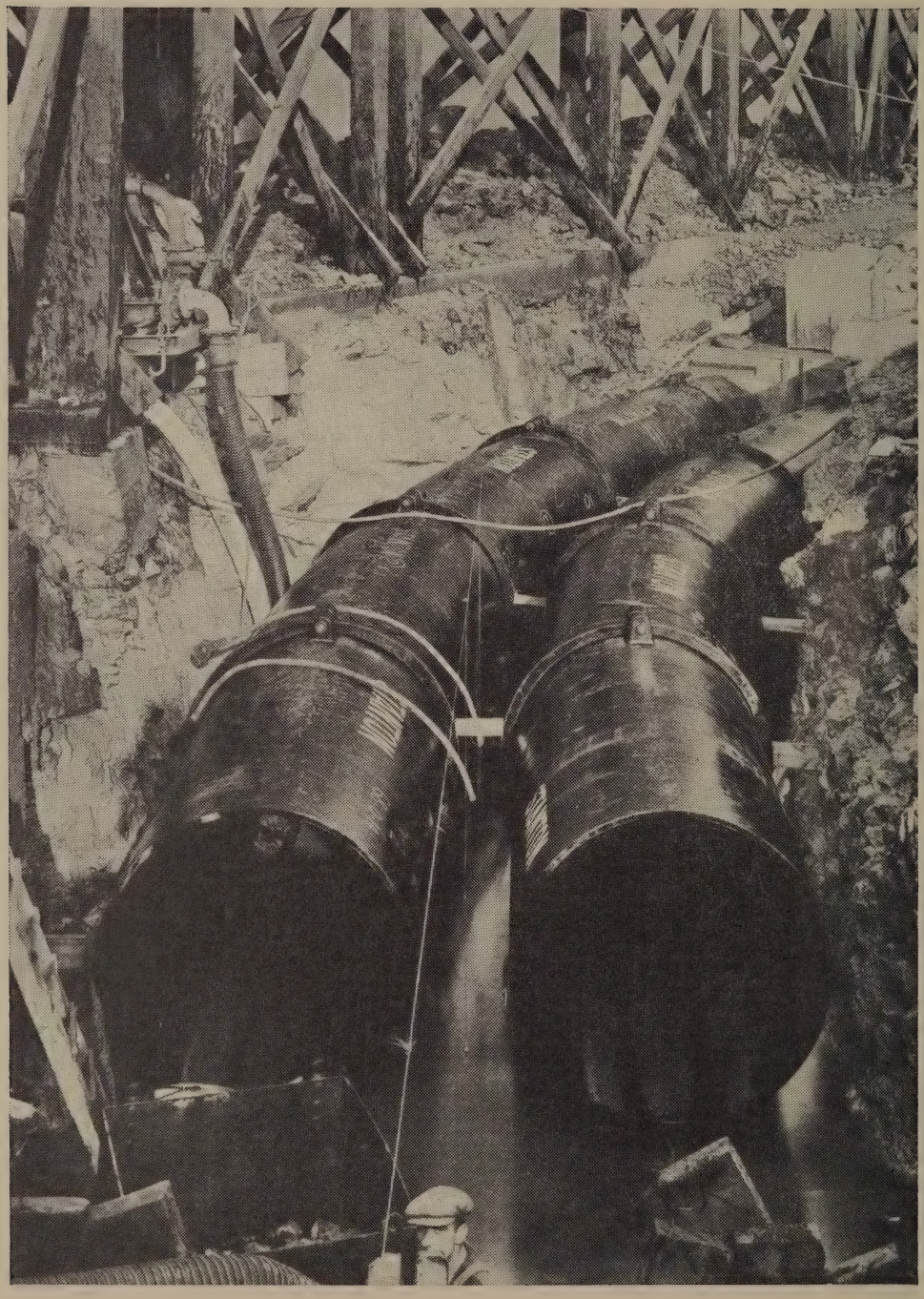
Contract No. 13—Parts of Morriston, Ynystawe and Clydach.

Contract No. 14—Port Tennant, St. Thomas and Old Guildhall area.

In order to ensure complying with the conditions of the grant in regard to the date for commencement of the works, it was decided that all efforts should be concentrated in preparing for and letting the two Contracts for the Main Trunk Sewer, after which the four groups of Subsidiary Sewers should be designed and prepared for contracts. Work on the Main Trunk Sewer (under Contract No. 8) was commenced on the stipulated date. Thereafter the works in the several groups were prepared in detail and let in separate contracts.

At the present time the Main Trunk Sewer (Contracts Nos. 8 and 9) as well as the Subsidiary Sewers in Contracts Nos. 11 and 13 are, with the exception of a few minor details, complete. The major portion of the works in Contract No. 10 are complete. The works in Contract No. 14 were commenced in July, 1936.

Arising however from circumstances which could not have been foreseen, it became apparent in the early part of 1935 that completion of the approved programme of works would not be achieved within the stipulated perod of five years from commencement. The Council therefore sought and were successful in obtaining an extension of one year to the said period, and it is confidently expected that completion will be attained within the extended period.



SEA OUTFALL—CAST IRON PIPES IN TRENCH

SWANSEA MAIN DRAINAGE SCHEME.

Part I—MAIN TRUNK SEWER.

Contract No. 8:

MUMBLES HEAD TO BRYNMILL.

Contractors: Messrs, Melville, Dundas and Whitson, Glasgow.

Length: approximately 4½ miles.

Work commenced December, 1931.

The works in this contract include the Main Sea Outfall, Storage Tanks and the Main Trunk Sewer, together with incidental works, extending from Mumbles Head to Brynmill, which is the point of junction with the works in Contract No. 9.

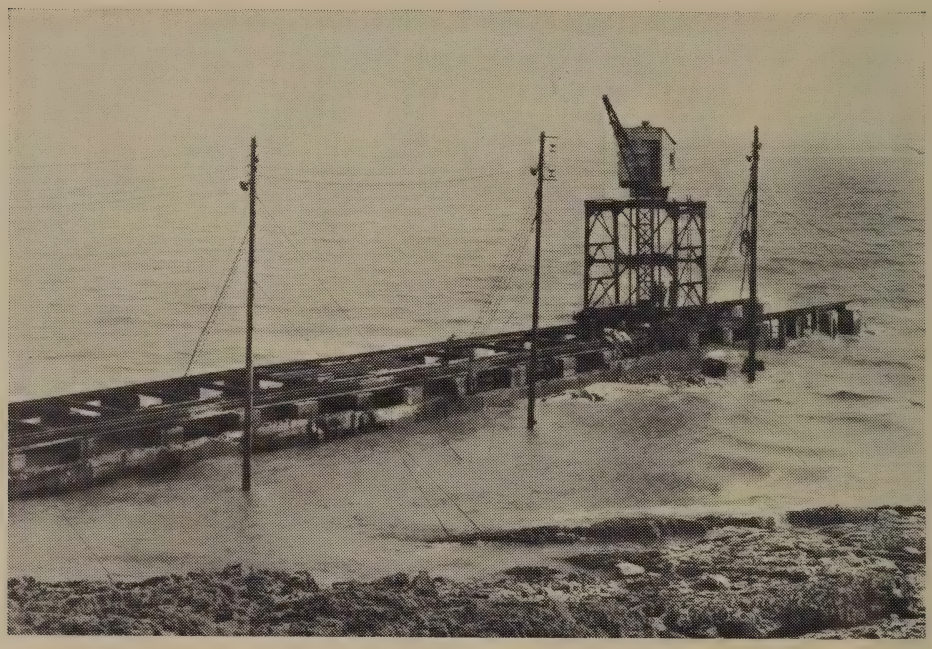
SEA OUTFALL across the foreshore, from the Storage Tanks in Mumbles Hill to just below low water mark ordinary Spring tides. Total length, 765 yards.

The outfall consists of a pair of 5ft. 0ins. diameter cast iron pipes laid partially in tunnel, but for the most part in open trench across the foreshore to a point about 220 yards due east of the Lighthouse.

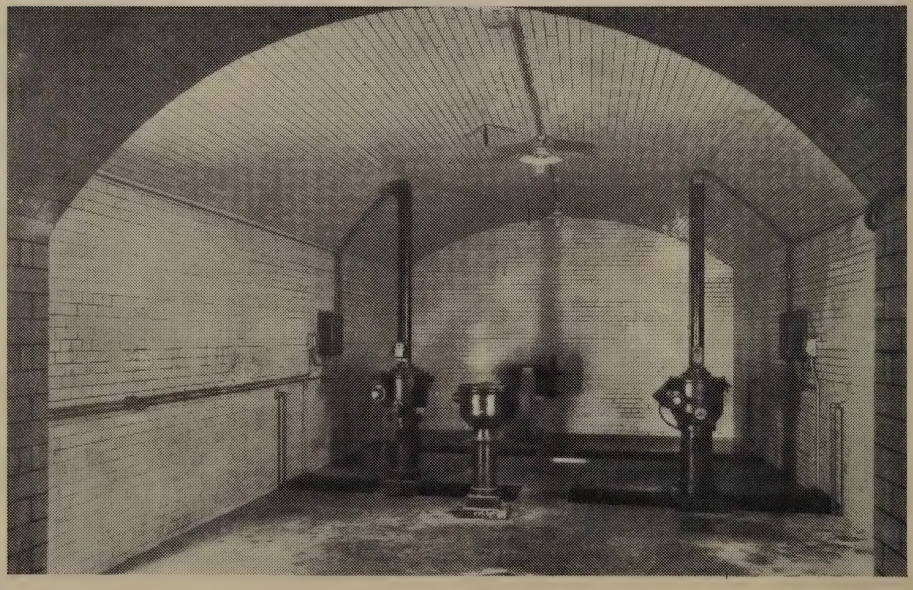
The pipes are laid side by side at 6ft. 9ins. centres, surrounded with concrete, the outlet discharging across a forebay formed in the rock sea-bed.

The total fall along the pipe line from the end of the Storage Tanks to the outfall bay is 15ft. 0ins., and the end of the pipes will be just submerged at low water ordinary Spring tides.

Arising out of difficulties brought about by the tidal conditions, the construction of the sea outfall proved the most hazardous. The available working time towards the seaward end was limited to a few days



SEA OUTFALL UNDER CONSTRUCTION AT MUMBLES HEAD



STORAGE TANKS—CONTROL ROOM OVER PENSTOCK CHAMBERS

during each range of Spring tides, as the work was carried out within a concrete cofferdam. Rough seas caused considerable delays, but the work was successfully accomplished.

PENSTOCK CHAMBER AND CONTROL ROOM.

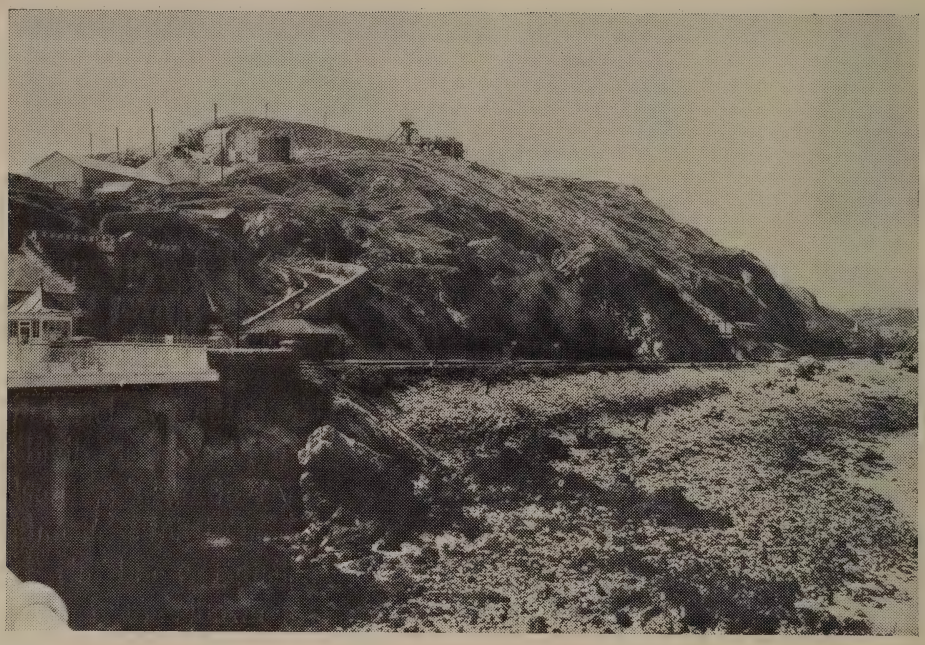
The penstock chamber is situate at the land end of the sea outfall pipes, and is reached by an access gallery with an entrance near Bracelet Bay.

The outlet collecting channels converge from the two left hand and two right hand storage tanks to a central outlet chamber, divided into two parts, but normally connected by means of open penstocks through the division wall. In each half of this central outlet chamber is an electrically operated penstock of 6ft. 0ins. diameter, and this pair of penstocks constitutes the main outlet control to the whole of the storage tanks, as the rectangular penstocks at each end of the tanks will normally be left fully open and only used for isolating a tank for purposes of cleaning and inspection.

This pair of main outlet penstocks will be electrically controlled by a tide clock, set in advance to work over two complete tide cycles daily, the clock operating relays to close both penstocks at five hours after high water and re-open them at nine hours after high water.

Beyond each of these two penstocks will be a 6ft. 0ins. diameter flap valve, to prevent the entry of sea water into the storage tanks when the penstocks are open and during certain conditions of tide level.

In the wall above the two main outlet penstocks is another pair of balanced relief flap valves, so that if the penstocks fail to open the tanks can still discharge above a certain level. The discharge through these penstocks and flap valves passes directly to the twin sea outfall pipes.



STORAGE TANKS—GENERAL VIEW OF MUMBLES HILL



STORAGE TANKS—Drilling at face preparatory to blasting.

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STORAGE TANKS.

The storage tanks are four in number, and together have a capacity slightly in excess of 4 hours of 6 times the Dry weather flow from a population of 250,000, so that the flow is stored for this period. This entails a storage of $7\frac{1}{2}$ million gallons, and each tank has a capacity of nearly 2 million gallons. The tanks are each 1995 feet long by 16ft. 6ins. wide by an average height of 10ft. 6ins. In the centre of each tank is a sludge channel to concentrate the flow during the final stages of emptying.

The four tanks have been tunnelled through very dense limestone rock, fissued in places, but generally sound, being at the deepest point about 200 feet below the top of Mumbles Hill. A pillar of rock 20ft. 0ins. thick has been left between each tank. The four tunnels were driven from the mid point toward the ends, work advancing concurrently on the eight faces. The excavated rock was raised through a shaft sunk from the top of Mumbles Hill. The quantity of rock excavated from the tunnels was approximately 75,000 cubic yards.

An access gallery constructed transversely above the tanks, at a point midway along their length, contains an extractor fan chamber; here foul air will be extracted from the tanks and delivered by a ventilating shaft into the open on the hillside above.

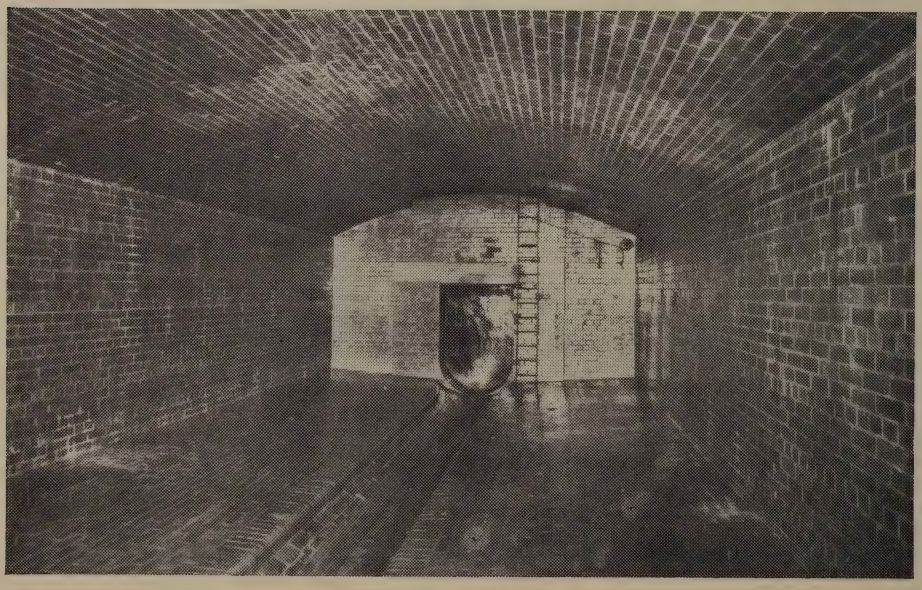
By controlling the admission and extraction gratings it will be possible to concentrate the fresh air supply to one or more tanks as required during cleaning or inspecting operations. The fan will have remote control operated from the screen-house, where a pilot light will be situated to indicate its working.

The tanks and inlet and outlet channels are constructed in brickwork throughout, with concrete backing.

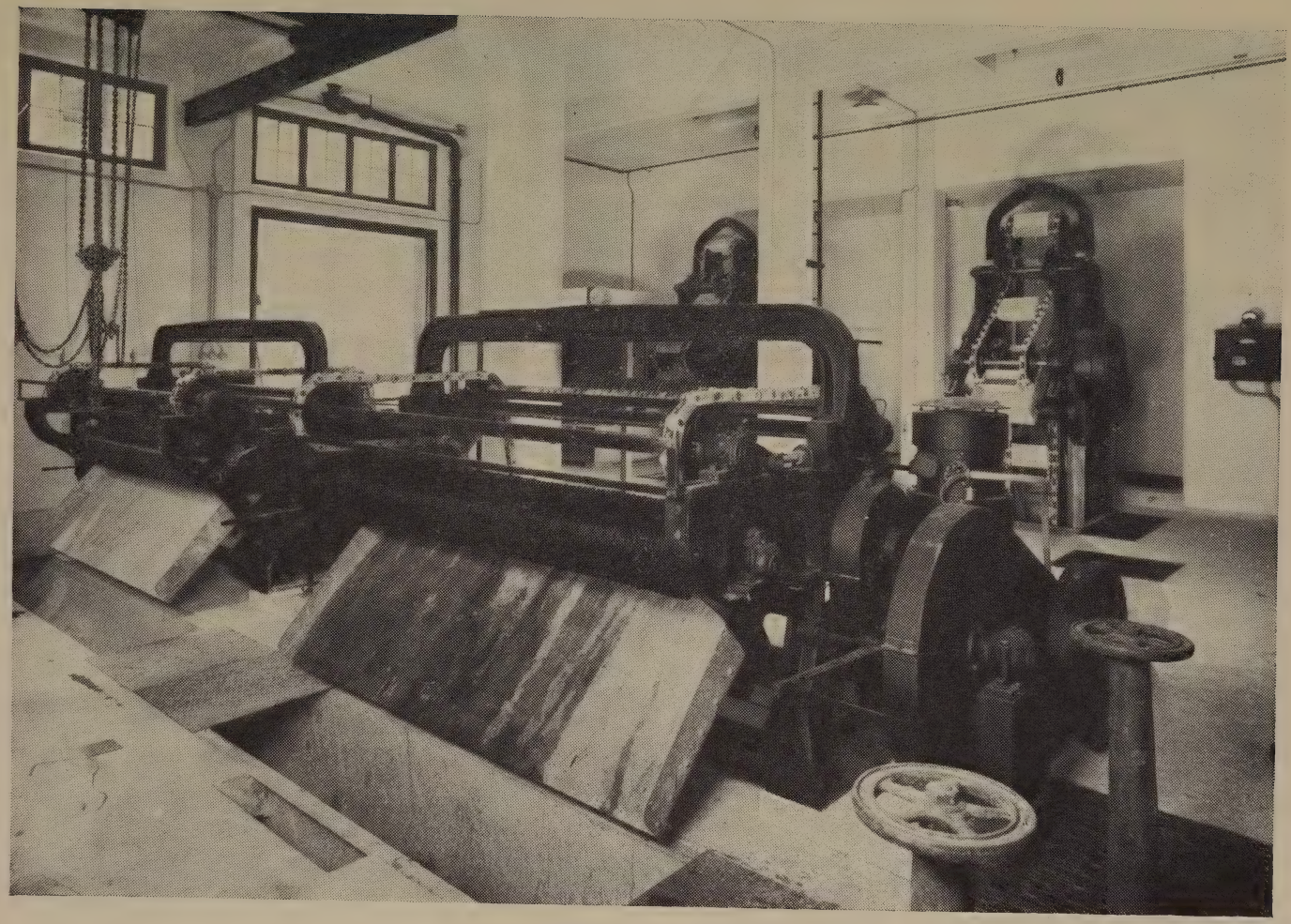
Either of the four tanks may be scoured out to the sea, if undue accumulation of silt renders this course necessary, by the process of discharging through it the contents of the other tanks.



STORAGE TANKS
(Concrete and brickwork lining under construction)



STORAGE TANKS
(View of inlet end of one tank)



SCREENING CHAMBER

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ATTENDANT'S HOUSE OVER THE SCREENING CHAMBER

Provision is also made for the future installation of high pressure water mains to flush down the walls and floors of the tanks should this be found necessary.

SCREENING CHAMBER.

This chamber adjoins the upstream end of the storage tanks, and receives the discharge from the Main Trunk Sewer.

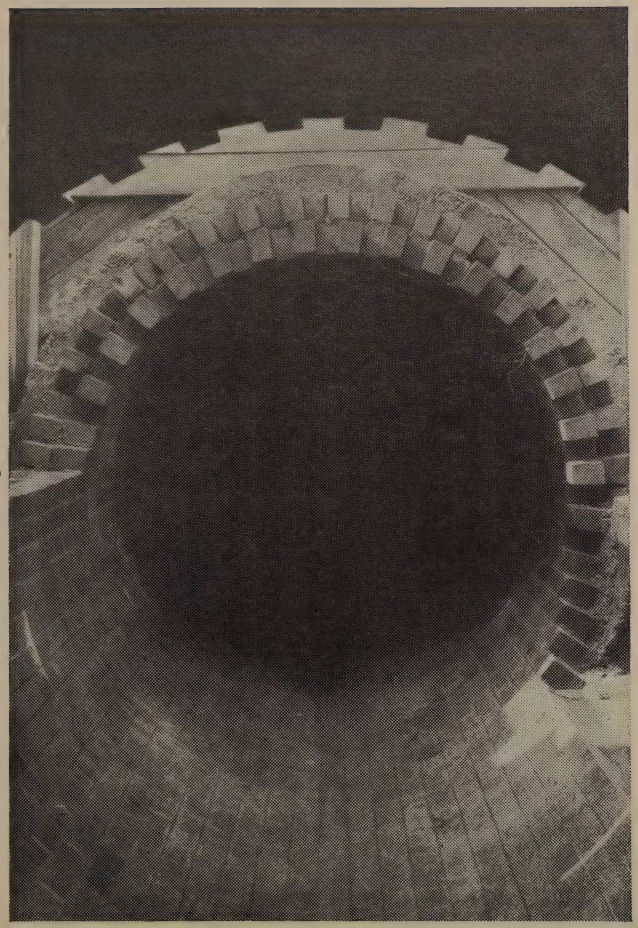
The incoming sewage flow is divided into two channels, exactly alike as regards screens, penstocks and other equipment ; each channel is capable of dealing with at least the full capacity of the sewer.

In each channel the sewage will pass over a pit so as to arrest the passage of pebbles and heavy solids, as it is desired to keep these from entering the pumps ; the detritus, however, will be carried forward.

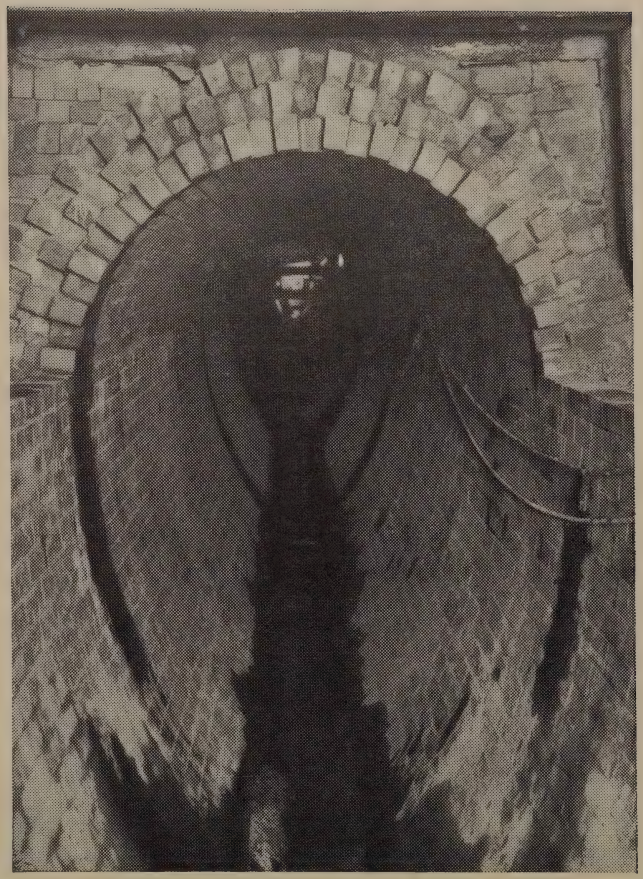
The pebbles and stones will be elevated from each pit by a telescopic continuous bucket elevator, electrically driven, and deposited in sealed bins which will be periodically collected and the contents disposed of.

The sewage will then pass through a 3-inch mesh coarse screen, kept clean by hand-operated rakes, as necessary, and after passing through a $\frac{1}{2}$-inch mesh fine screen, electrically raked, will flow on into the storage tanks. The deposits on the fine screens will be raked up to floor level and fall into a metal trough filled with water. When sufficient screenings have accumulated in the trough, they will be fed into a disintegrator pump whence they will again be delivered in front of the fine screens. Any solids which now fail to pass through the screens are again automatically raked off and the process repeated until thorough disintegration has taken place.

At night the fine screen mechanism is so arranged that the raking machinery will automatically come into operation if the screens become choked.



MAIN TRUNK SEWER—In BURROWS, BLACKPILL to SKETTY LANE
(Brick and concrete circular section—in trench)



MAIN TRUNK SEWER—OYSTERMOUTH TO BLACKPILL
(Brick and concrete ovoid section—in tunnel)

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To guard against breakdown by failure of the electric power supply, a sufficient space has been left over the tops of the screens to prevent overflowing of the channel if the level of the sewage should rise above them.

In the screen-house, pilot lamps will indicate to the attendant if the outlet penstocks are open or shut, and whether the ventilating fan is in operation or not.

The screen-house is built of reinforced concrete and the channels in concrete and brickwork.

The attendant's house, which is built over the screening chamber, was designed by the Borough Architect (E. E. Morgan, Esq., F.R.I.B.A.).

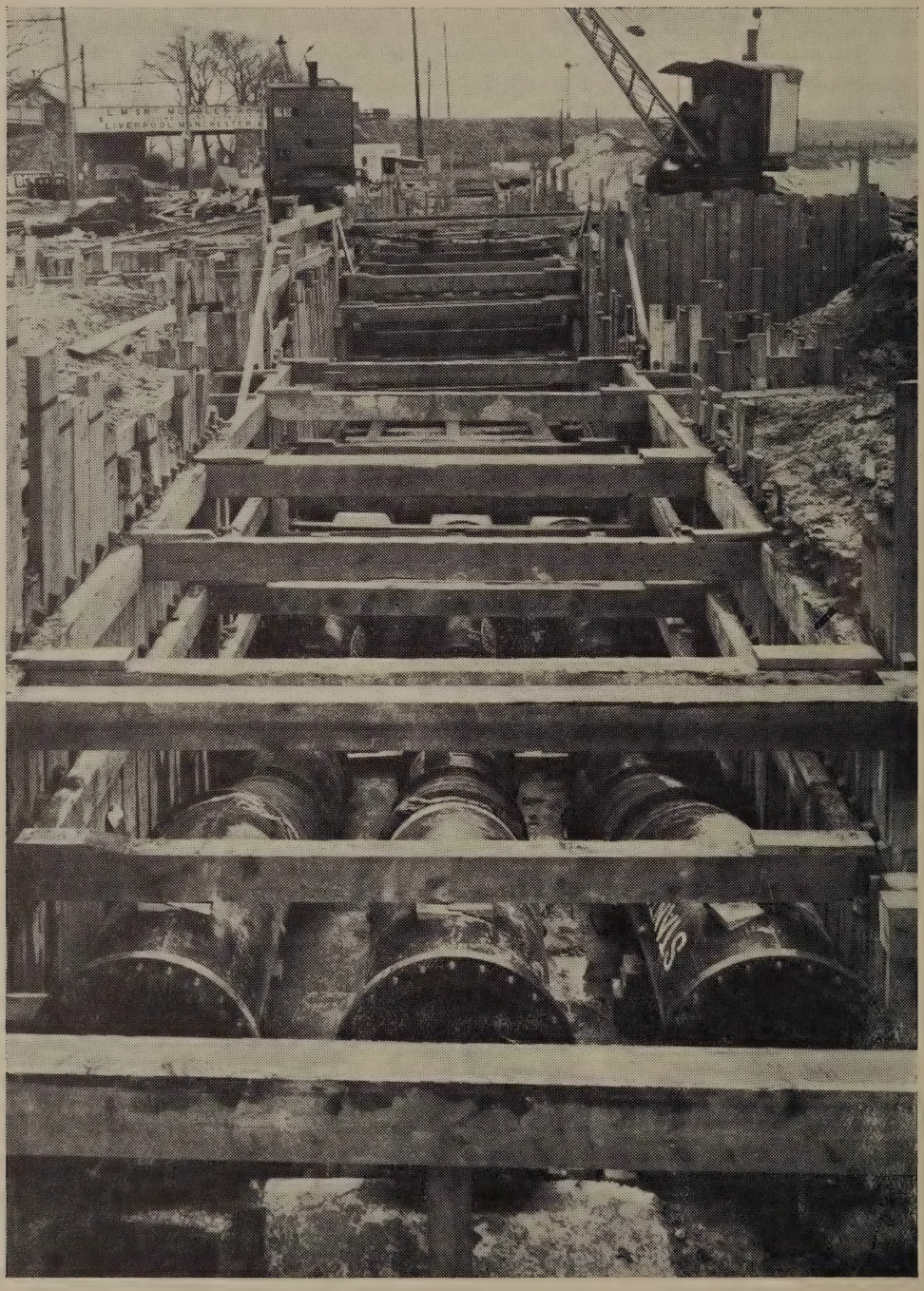
MAIN TRUNK SEWER (Southend to Brynmill).

The sewer contained in this section of the work decreases in size from 7ft. 9ins by 5ft. 6in. ovoid section at its point of entry into the Screening House, to 5ft. 6ins. diameter at Brynmill.

The 7ft. 9ins. by 5ft. 2ins. ovoid sewer extends for 1,200 yards in open cutting from the screening chambers at Southend to Oystermouth Station Yard. At this point the size changes to 7ft. 6ins. by 5ft. 0ins., and this continues partly in trench and partly in tunnel to Blackpill, opposite Derwen Fawr Road, the route followed being partly within and partly beside the Mumbles Road.

A special feature of this length is the syphoning of the Main Tunk Sewer underneath the Clyne River diversion (near Blackpill Station), Here the syphon takes the form of three 3ft. diameter cast iron pipes dipping below the new concrete culverts carrying the diverted Clyne River, with a large brick chamber containing penstocks at either end.

From Derwen Fawr Road to Brynmill the sewer is reduced in size to 5ft. 6ins. diameter, and is constructed wholly in open cutting. Up to a point near the junction of Sketty Lane the sewer is constructed



MAIN TRUNK SEWER—SYPHON UNDER CLYNE RIVER, BLACKPILL

in brick and concrete, but at this point, owing to the existence of a layer of peat, the construction was altered to cast iron pipes supported on reinforced concrete piles.

It was necessary to carry the sewer under the embankment of the L.M.S. Railway at Blackpill, and the use of cast iron tubbing was resorted to for the tunnelling process at this point.

INCIDENTAL WORKS on the route of the Main Trunk Sewer include—

(1) Syphoning of several existing streams and drains across and underneath the main trunk sewer.

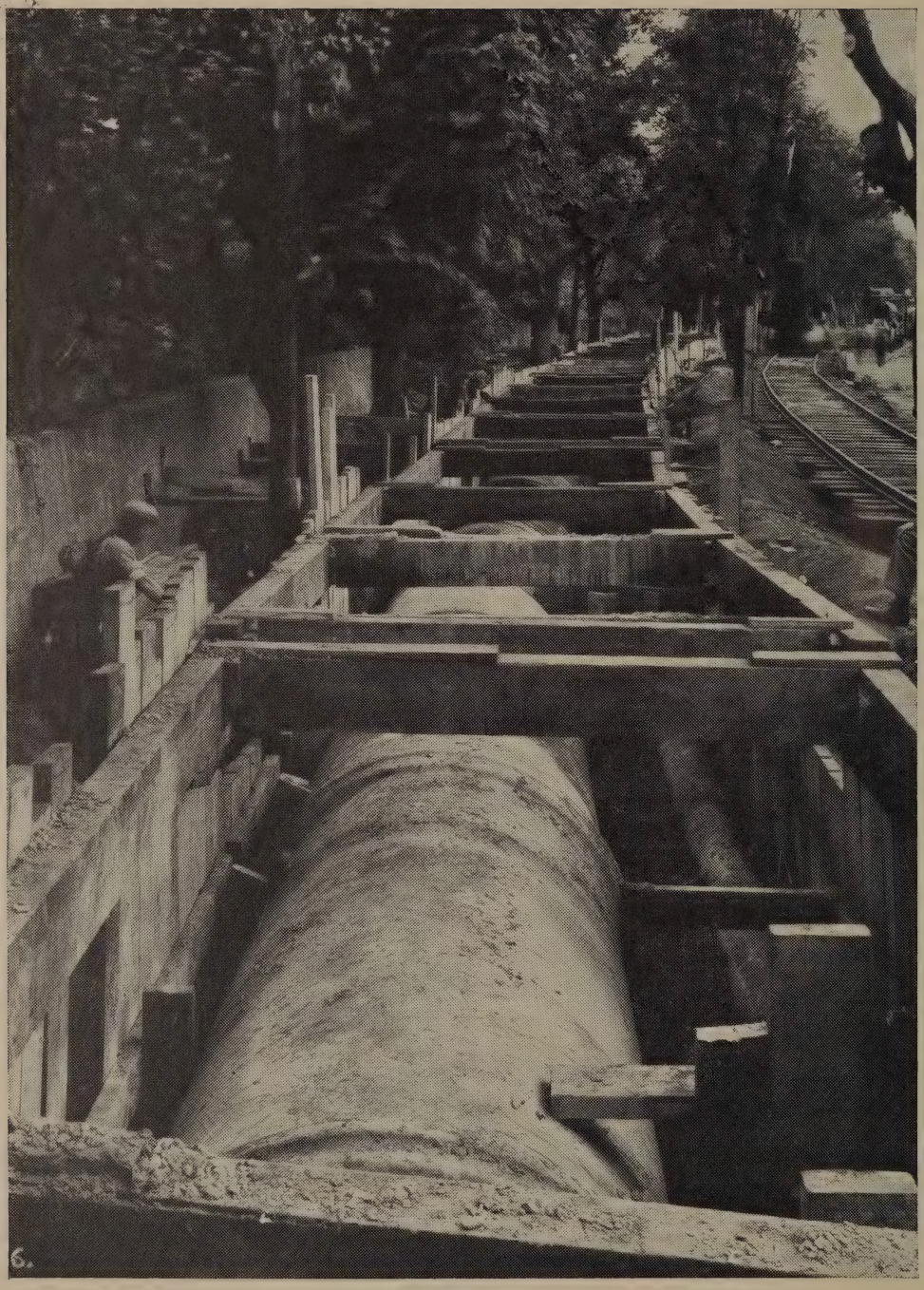
(2) The reconstruction of certain culverts carrying streams.

(3) Alterations to certain existing pipe sewers and surface water drains.

(4) The diversion of the Clyne River at Blackpill through twin concrete culverts. This work was necessitated in order to overcome certain difficulties in constructing the syphon on the main trunk sewer under the old course of the river.

(5) Diversion of Brynmill Stream. The line of sewer cut immediately through the old course of the Brynmill Stream, and it was therefore diverted on to the route of the main trunk sewer and immediately underneath it where it crosses the Mumbles Road, thence under the railway and to the foreshore.

(6) The construction of 44 manholes on the main trunk sewer, together with several manholes on existing sewers, to control the flow of sewage into the main trunk sewer and to deal with storm water in existing sewers.



MAIN TRUNK SEWER—IN RECREATION GROUND, BRYNMILL

(Cast iron pipe construction)

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PART I.—MAIN TRUNK SEWER (continued).

Contract No. 9:
BRYNMILL TO CLYDACH.

Contractors: Messrs. Kinnear, Moodie and Co., London.

Length: Approximately 7 miles.

Work commenced November, 1932.

The work involved in this contract commences at its junction with Contract No. 8 in the South-west corner of Singleton Park at Brynmill, traversing the main town area of Swansea and extending along the Swansea Valley to its termination at Clydach.

At Brynmill the sewer is 5ft. 6ins. diameter, and decreases in stages to 2ft. 0ins. diameter at its head at Clydach. At selected points on the existing sewers adjacent to the course of the Main Trunk Sewer, storm water overflows have been constructed, at which points quantities up to 6 times the Dry Weather Flow of sewage will be turned into the main sewer, all storm water in excess thereof passing on to discharge at existing outlets.

The main sewer in this Contract is divided into four main sections, as follows :—

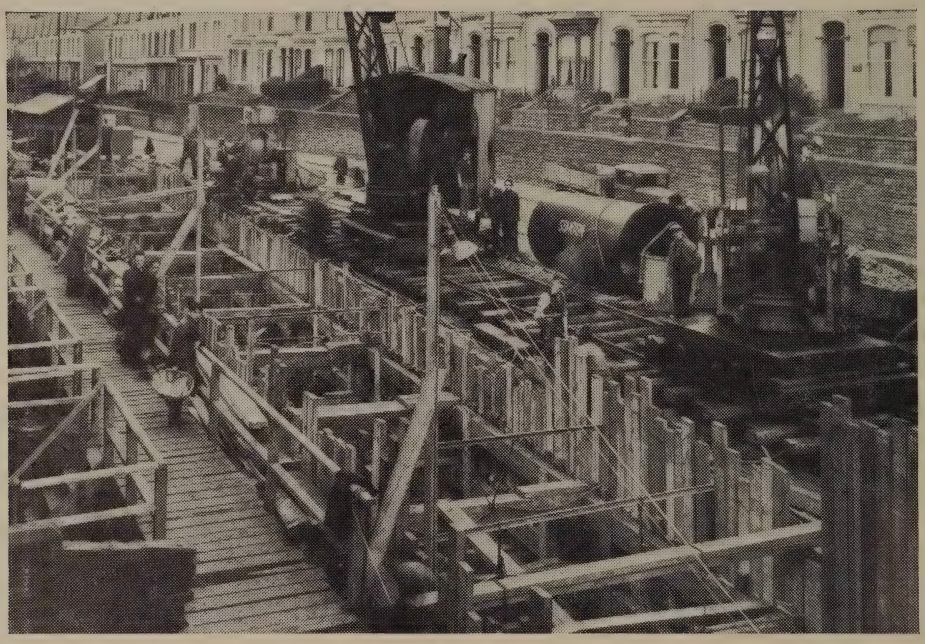
(1) BRYNMILL TO CATHERINE STREET—length 0.85 miles.

Route—Recreation Ground, St. Helen's Cricket Field, King Edward Road, Brynymor Road, and Catherine Street (about mid-way).

Size—5ft. 6ins. diameter to junction with Brynymor Road ; 5ft. 3ins. dia. to end of section.

Construction—In cast iron pipes with concrete protection. All in open trench. The depth to invert varies from 6ft. 6ins. to 20ft. 0ins.

Cast iron pipe construction for the sewer was adopted in this section with the object of speeding up construction so as to minimise inconvenience to the public and interference with the tramway service.



MAIN TRUNK SEWER—IN KING EDWARD ROAD
(Cast iron pipe construction)



MAIN TRUNK SEWER—IN BRYNYMOR ROAD
(Cast iron pipe construction)

In this connection the tramway service on the Brynmill-Wind Street route was suspended for a perod of four months, and a bus service, involving an alternative route for the King Edward Road length, substituted therefor.

The strata met with was generally good, consisting mainly of clay, gravel and ballast. At the commencement of the section, viz., through the Recreation Ground, peat was encountered, which necessitated the adoption of concrete piers to support the structure.

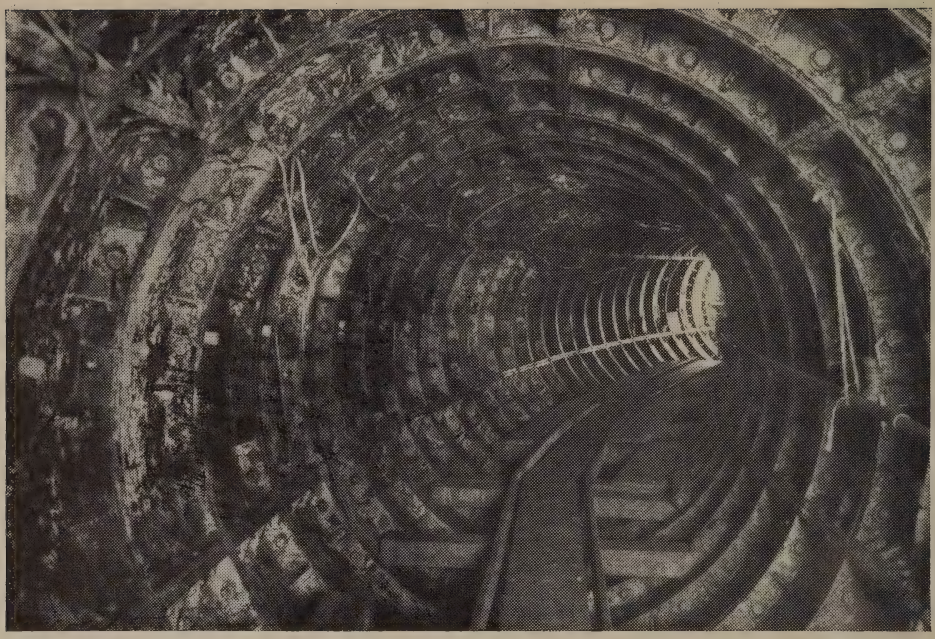
Auxiliary Works in this section were the laying of (*a*) 12in. dia. concrete pipe surface water drain in the Recreation Ground ; (*b*) a 30in. dia. concrete pipe storm water drain in King Edward Road (from opposite Rhyddings Park Road to Brynymor Road with branches to the existing sewers in Brynymor Crescent and Westbury Street) ; (*c*) the disconnection of all street gullies in King Edward Road and part of Brynymor Road from the existing sewers and their connection to the new storm water drain ; and (*d*) the construction of several storm overflow chambers on existing sewers with sewer connection to the main sewer.

(2) CATHERINE STREET TO PLASMARL (BRITANNIA ROAD) —length 2.76 miles.

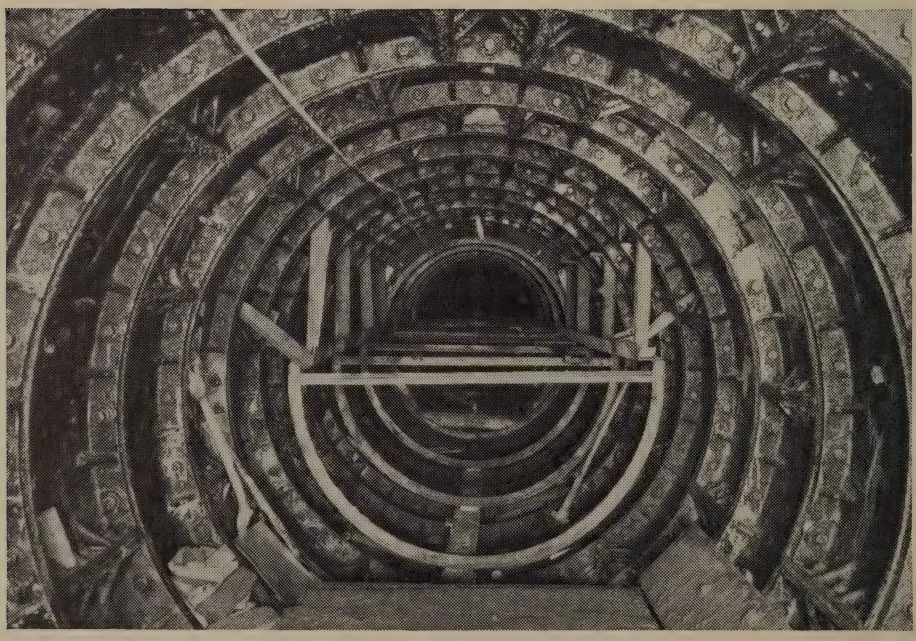
Route—Lane rear of St. Helen's Road and Northampton Place (North Side), Pell Street to bottom of Dynevor Place, College Street, High Street, Greenhill Street, Bridge Street, Neath Road.

Size—5ft. 3ins. dia. to Cradock Street (Pell Street) ; 4ft. 9ins. dia. to junction of Greenhill Street and Carmarthen Road ; 4ft. 0ins. dia. Greenhill Street to Hafod Bridge.

Construction—Brick and concrete lining contained within a shield-driven cast iron tunnel, made up of flanged segments bolted



MAIN TRUNK SEWER—CATHERINE STREET TO PLASMARL
(Cast iron tunnel preparatory to lining with concrete)



MAIN TRUNK SEWER—CATHERINE STREET TO PLASMARL
(Cast iron tunnel showing preparations for concrete lining)

together. Wholly in tunnel. The depth to invert varies from 20ft. 0ins. to 76ft. 0ins.; maximum depth at Neath Road, Hafod (Bowen Street).

The work in this section traverses the principal business thoroughfares of the town area, and a notable feature of this portion of the work was that the tunnel was built in the form of a cast iron tube, similar to that adopted on the London Underground Electric Railways. This tunnel was driven from four main working shafts situated at George Street, High Street (near Tontine Street), Neath Road, Hafod (Bowen Street), and Neath Road, Landore (opposite the old Millbrook Works). The tunnel excavations advanced in opposite directions from these four shafts, and junctions were effected as follows :—

at Catherine Street—junction with open trench ;

at Orchard Street ;

at Hafod Bridge ;

at Neath Road, Landore (near Landore Cinema) ;

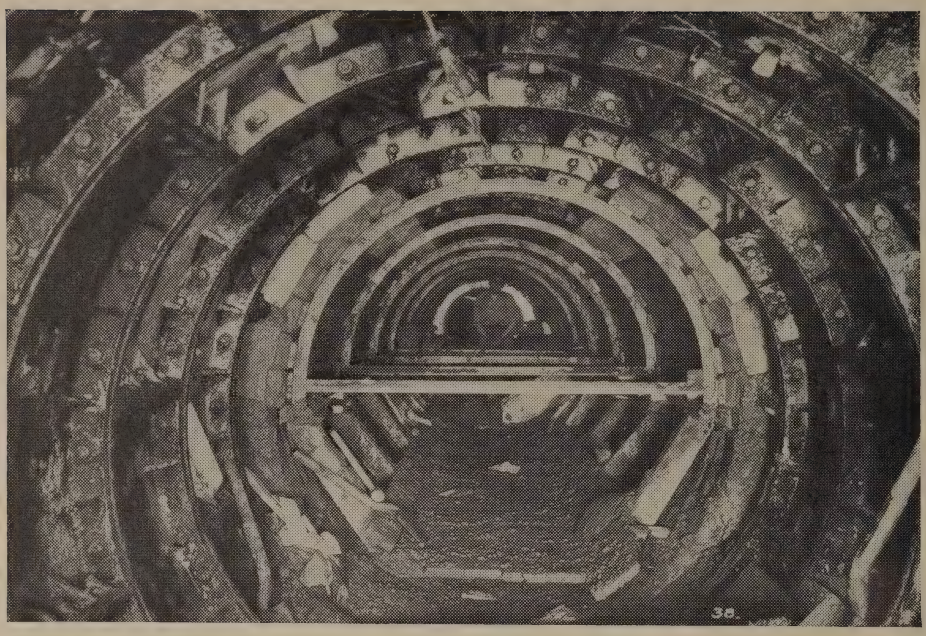
at Neath Road, Plasmarl (with tunnel in next section).

By this method of working, the minimum of inconvenience was caused to the public.

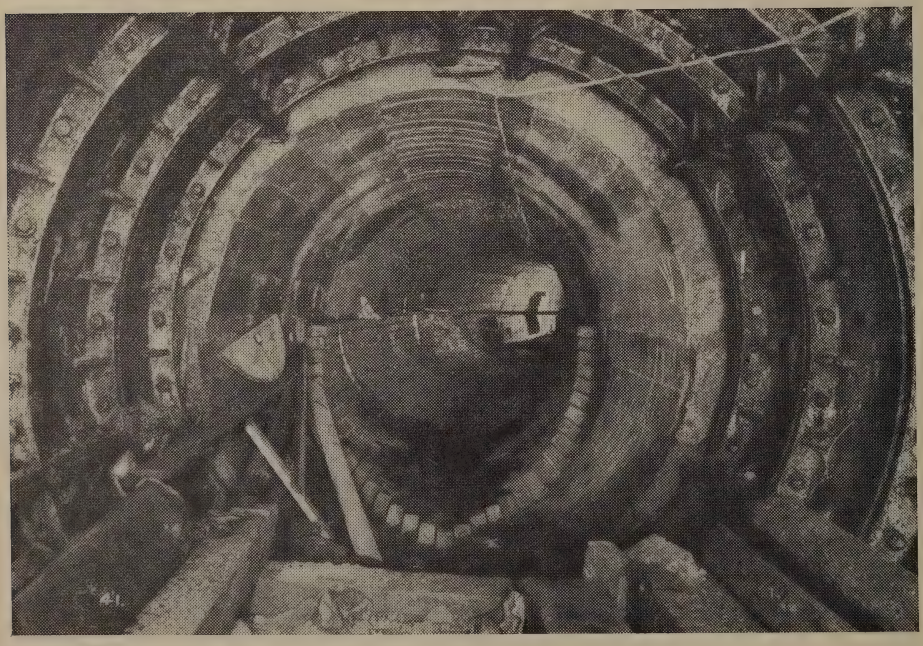
The strata encountered in the tunnel drivages consisted mainly of gravel, ballast and clay up to the region of The Palace, in High Street ; from this point to near Hafod Bridge and in the lower part of Plasmarl the tunnel passed through sandstone and shale respectively. In the Hafod and Landore districts the strata varied from ballast to fine silt.

Owing to the large quantities of water in the ground, the tunnel excavations were driven under compressed air, with the exception of the two faces worked from the George Street Shaft.

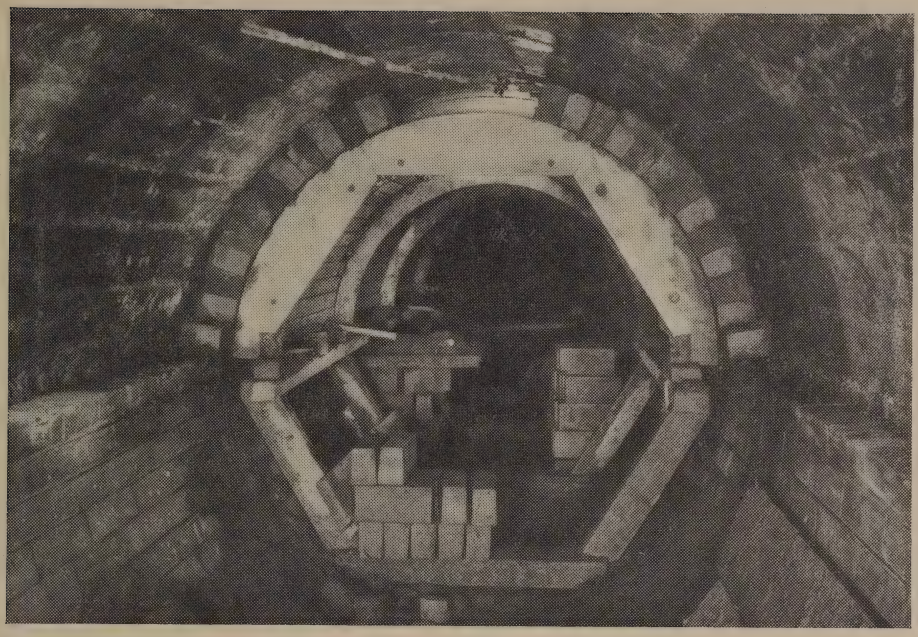
The working faces were advanced by the use of hooded shields, which were pressed forward by hydraulic rams working against the last ring of tunnel fixed. The advance of the shield at each operation



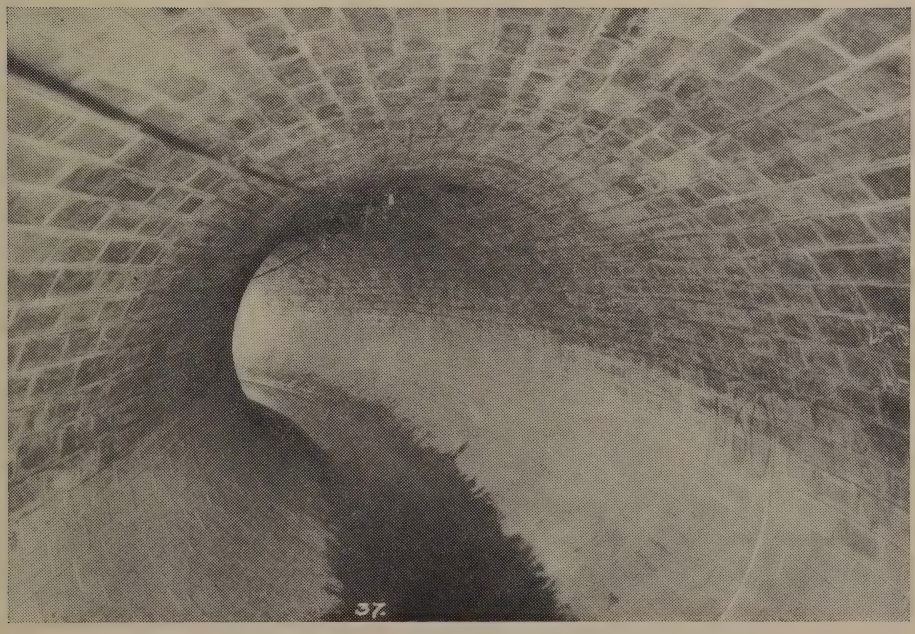
MAIN TRUNK SEWER—CATHERINE STREET TO PLASMARL
(Concrete lining under construction)



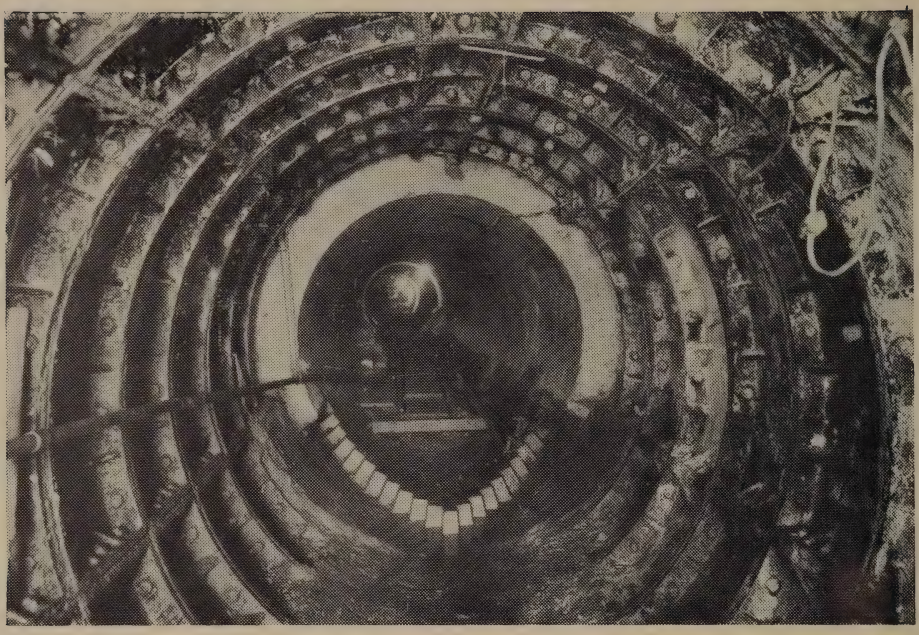
MAIN TRUNK SEWER—CATHERINE STREET TO PLASMARL
(Brick lining under construction within completed concrete lining)



MAIN TRUNK SEWER—CATHERINE STREET TO PLASMARL
(Brick lining under construction within completed concrete lining)



MAIN TRUNK SEWER—CATHERINE STREET TO PLASMARL
(Completed brick lining)



CWMGELLY STREAM—CULVERT DIVERSION.
(Cast iron tunnel, shewing concrete lining and brick invert)



CWMGELLY STREAM—CULVERT DIVERSION
(Completed work)

was sufficient to permit of the erection of a complete ring of tunnel lining (the length of each ring being 1ft. 9ins.), which was then bolted to the last ring built. Excavation at the face proceeded within the shield, and thus the lining of the tunnel kept pace with the advance of the shield.

On completion of the cast iron tunnel lining, the shafts for the access manholes were sunk at intervals along the route, and the tunnel lined successively with concrete and brickwork to form the completed sewer.

Auxiliary Works in this section included—

(*a*) Storm water overflow chambers on existing sewers, with sewer connection to the main sewer.

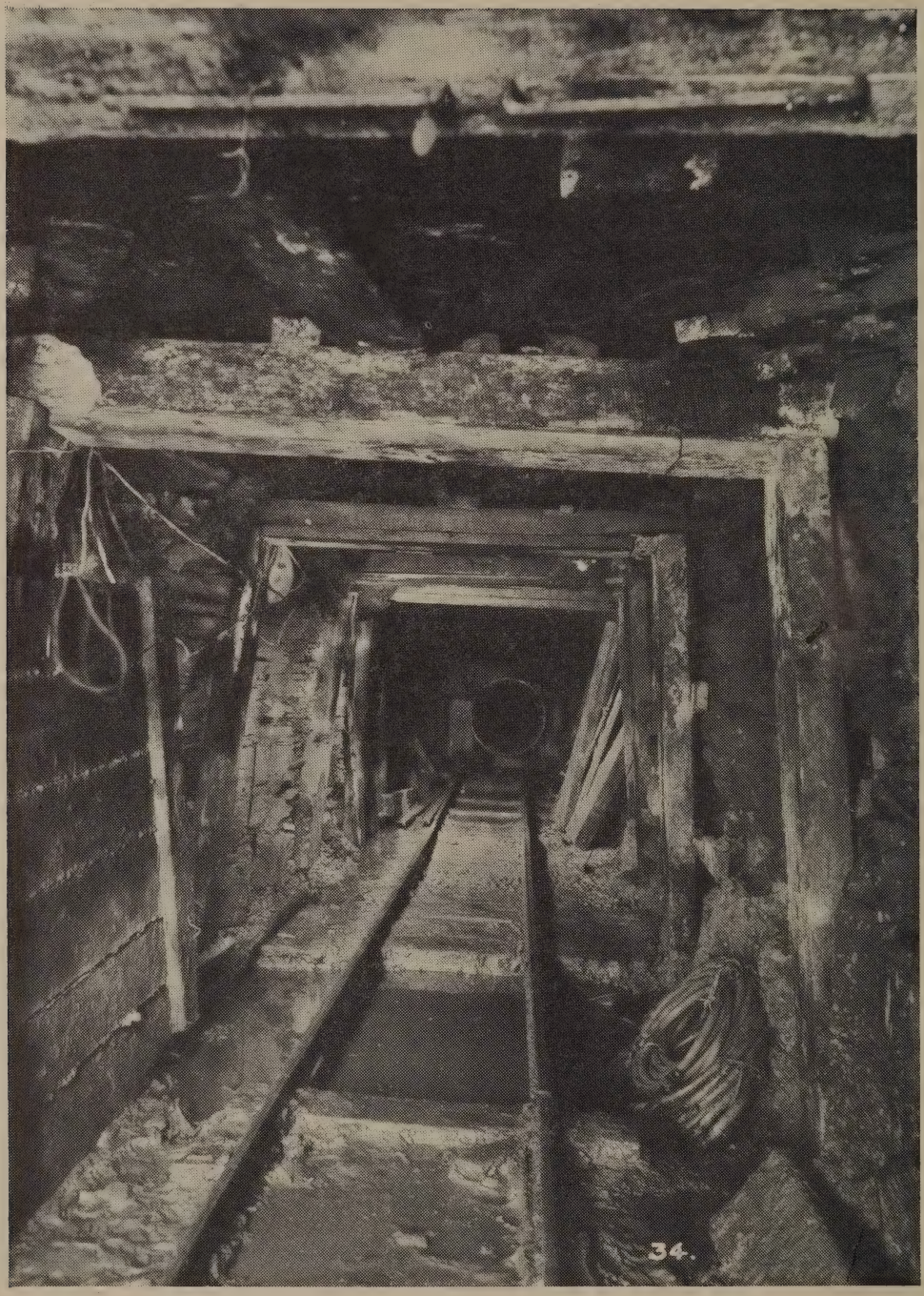
(*b*) Diversion of the Cwmgelly Stream Culvert crossing under the Neath Road at Landore. This comprised a new cast iron tunnel 110 yards in length, lined internally with concrete, and having a brick invert. The finished diameter of this culvert is 8ft. 0ins.

(3) PLASMARL TO SWAY ROAD, MORRISTON (CHEMICAL ROAD)—length 1.41 miles.

Route—Neath Road (along Morriston Common), Market Street, Glantawe Street, Clase Road to Morriston Cross, Sway Road (Chemical Road).

Size—3ft. 6ins. dia. to a point opposite Swan Hotel ; 3ft. 0ins. dia. to Sway Road (Fagwr Place) ; 3ft. 0ins. x 2ft. 0ins. ovoid section in Sway Road (from near Fagwr Place to Chemical Road).

Note—No new construction between Zoar Terrace and Chemical Road as the existing sewer was found to be suitable in size and gradient.



MAIN TRUNK SEWER—PLASMARL TO MORRISTON
(Cast iron pipe construction, in tunnel)

Construction—In cast iron pipes with concrete protection to Sway Road (Fagwr Place) ; brick and concrete (Fagwr Place to end of section). Wholly in tunnel. The depth to invert varies from 24ft. 0ins. to 68ft. 0ins ; maximum depth at Trewyddfa Common.

The tunnels in this section were driven from nine working shafts. working in opposite directions to form junctions at intermediate points. At these intermediate points shafts were afterwards sunk to the tunnel, and these shafts, together with the main shafts, accommodated the access manholes which were later built upon the sewer.

The tunnels were of rectangular sections, timber supports being inserted where necessary.

The strata encountered was mainly hard shale, clift and sandstone, with stretches of boulder clay and fireclay. Several thin bands of coal were passed through.

The strata in this section was very water bearing, which necessitated the employment of powerful pumps at each of the main shafts to maintain working conditions in the tunnels.

Auxiliary Works in this section comprised the construction of storm water overflow chambers on existing sewers and connections to the main trunk sewer.

(4) MORRISTON (CHEMICAL ROAD) TO CLYDACH (WESTERN LANE)—length, 2.01 miles.

Route—Clydach Road to Waunforgan, private gardens alongside Swansea Canal, through Ynystawe to Canal Road (Bwllfa), and regaining Clydach Road near Miller's Arms, thence along Clydach Road crossing borough boundary at Cwmdwr, and terminating at junction of Western Lane, 130 yards beyond the borough boundary and within the Rural District of Pontardawe.



MAIN TRUNK SEWER—AT YNYSTAWE
(Cast iron pipe construction)

Size—2ft. 3ins. to Clydach Road, Ynystawe (near Miller's Arms); 2ft. 0ins, to end of section.

Construction—In cast iron pipes with concrete protection. In Open Trench : Chemical Road to near Midland Hotel, Forward Movement Hall to Ynysforgan Railway Viaduct, Ynysforgan Hill to Ynystawe (Canal Road).

The depth to invert varies from 3ft. 0ins to 17ft. 0ins.

In Tunnel : From near Midland Hotel to near Forward Movement Hall ; Ynysforgan Railway Viaduct to Ynysforgan Hill ; Ynystawe (Canal Road) to Clydach (Western Lane).

The depth to invert varies from 17ft. 0ins. to 53ft. 0ins. ; maximum depth at Ynystawe.

The strata encountered consisted mainly as follows :—Upper Morriston : sandstone rock and boulder clay ; Ynysforgan district : shale ; Lower Ynystawe : gravels, clays and loams ; Upper Ynystawe : sandstone rock, clift and shale. The strata overlying the rock formation in Upper Ynystawe was very water bearing, but this was adequately dealt with by pumping ; otherwise no undue quantities of water were met with.

Auxiliary Works in this section comprised a stream diversion and re-grading at Waunforgan, and the construction of a storm water overflow at Ynysforgan.

PART I.—MAIN TRUNK SEWER—(continued).

General Points of Interest.

Total Length	11½ miles (approx.)
Total Fall from Clydach to Mumbles Head—Point of Outfall	71 feet
Depth Below Surface—Max. to invert	76 feet
Manholes—Number of	157

Distance apart, approx. 160 yards; Construction mainly in brickwork. All Manholes on sewers of 3ft. 0in. diameter and over are provided with flood (safety) chains.

Approximate Quantities of Principal Materials used—

Bricks	10,000,000
Cement	14,000 tons
Cast Iron Tunnel Segments	3,912 tons
Cast Iron Pipes	8,636 tons

Maximum Number of Workmen employed at one time—

Contract No. 8	644
Contract No. 9	844

Part II—SUBSIDIARY SEWERS

As already stated, certain groups of the Subsidiary Sewers were put in hand in the year 1922, the order of priority for constructional purposes being dictated by the districts where the need for sewerage facilities was greatest.

The Subsidiary Sewers are located for the most part in the areas added to the borough in 1918, since the built-up areas within the former borough boundary were, generally speaking, provided with sewers.

These works are contained in nineteen separate groups, eleven of which were carried out by Contract and eight by Direct Administration.

Several of the groups represent extensions of the existing sewers, which latter are to be intercepted by or connected to the Main Trunk Sewer ; other groups are new systems of sewers for direct connection to the Main Trunk Sewer. Moreover, included in some of the groups are provisions for making extensive alterations to certain of the existing sewers, as well as for constructing new storm-water drains and culverts, for the purposes of diverting flows and regulating volumes so as to adapt the existing sewerage systems to the new conditions visualised under the Main Drainage Scheme and to enable them to function in accordance therewith.

Certain low-lying districts served by the Subsidiary Sewers cannot be drained by gravitation to the Main Trunk Sewer, and the sewage from these districts will therefore have to be raised by pumping to the requisite levels. (An exception is made in the case of the Cockett, Fforestfach and Waunarlwydd sewers, which, as hereinafter referred to, are not connected to the Main Trunk Sewer).

Sewage pumping installations have been provided as follows :—

District.	*Location of Pumping Station.*	*Point of Connection to Main Trunk Sewer.*
Llansamlet	Llansamlet Road	Neath Road, Morriston (near Copper Pit)
Cwm	,,	,,
Winchwen	,,	,,
Lower Morriston	Wychtree Street, Morriston	,,
Newton & Langland	Langland Bay (car park)	The Dunns, Oystermouth
Port Tennant	Near Burrows Inn	Cradock Street
Sandfields and old Guildhall Area, Strand	East Burrows Yard (near Old Guildhall)	(Northampton Lane) ,,
*Cockett, Fforestfach and Waunarlwydd	Near Penyfodau Farm, Gowerton	Sludge pumping plant on Sewage Treatment Works.

*Outfall to Loughor Estuary.

In addition to the above a separate pumping station to deal with storm water is provided near the Old Guildhall.

The pumps in the above mentioned installations are of the vertical spindle type, electrically operated and fitted with automatic float control.

Several of these groups of sewers contain civil engineering and structural works of considerable magnitude in the form of river and canal crossings, large culverts and drains, and pumping stations in reinforced concrete.

The total length of the Subsidiary Sewers is approximately 45.5 miles. (See Schedule of works on pages 54, 55). The sewers are mainly of stoneware and cast iron pipe construction, of which considerable lengths have been laid in deep tunnel.

A notable feature of the works contained in Contract No. 14, viz., that for the sewerage of Port Tennant, St. Thomas and Old Guildhall area, is the bringing of the sewage of the Pentrechwyth, Foxhole, St. Thomas and Port Tennant districts—all on the east side of the River Tawe—by means of a tunnel under the river to the pumping station on the West bank of the river near the Old Guildhall. Here it will join the sewage gravitating to this point from the Sandfields and Strand areas, whence the combined volumes will be pumped through a rising main to the Main Trunk Sewer in Cradock Street. The tunnel under the river and associated shafts on each bank thereof will be constructed in cast iron segments bolted together, the excavation work and lining the shafts and tunnel being done under compressed air.

The sewer across the river will be of cast iron and steel pipes, in the form of an inverted syphon, contained within the shafts and tunnel. Provision is made for the ventilation and electric lighting of the tunnel for inspection purposes.

Another important and much needed work contained in Contract No. 14 is the construction of a new 8ft. 0ins. internal diameter culvert, mainly in deep tunnel, from Hafod Bridge to the River Tawe at Pipe House Wharf, length about one-third of a mile, to replace the existing defective and inadequate culvert at present carrying the Burlais Brook in the Upper Strand.

With the completion and bringing into commission of these Subsidiary Sewers the sewage of the whole of the borough (with the exception of that from the Cockett, Fforestfach and Waunarlwydd

districts, hereinafter referred to) will be connected to the Main Trunk Sewer, and conveyed for discharge into the Bristol Channel at a point beyond Mumbles Head.

The sewage from the districts of Cockett, Fforestfach and Waunarlwydd which lie beyond the western watershed of the Swansea valley, gravitates to a sewage treatment works at Gowerton, outside the borough, whence it is discharged into the tidal waters of the River Llan, flowing into the Loughor Estuary.

With the completion of the Swansea Main Drainage Scheme the waters of the River Tawe and Swansea Bay will be freed of the sewage pollution which has persisted therein for upwards of a century. In addition to having contributed in a substantial degree towards the relief of unemployment in the district, the completion of the work will mark the realisation of a long felt sanitary need in providing the borough with an adequate and satisfactory system of sewerage which cannot but have a beneficial effect upon the well being of its inhabitants and upon the amenities of the community.

PART II.—SUBSIDIARY SEWERS (for locations see Key Map).

	District.	*Length of Sewers*	*Contractor.*	*Date.*
		Yards		
Contract No. 1	Carmarthen Road, Kings Head Road, Armine Road and Middle Road	2,172	A. Farley, Pontardulais	1922—1923
Contract No. 2	Cefn Road, Bonymaen, Cwmrhydyceirw	1,030	A. Farley, Pontardulais	1922
Contract No. 3	Llangyfelach Road, Parry Road, Caemawr Road and Tanylan Terrace, Morriston	1,487	Hanney Bros., Swansea	1922—1924
Contract No. 4	Llansamlet	8,257	South Wales Contractors Ltd., Penllergaer	1925—1928
Contract No. 4A	Llansamlet Pumping Station and rising Main to River Tawe	2,115	South Wales Contractors Ltd., Penllergaer	1928—1930
Work No. 4C **Work No. 4B**	Cwm and Winchwen Trallwn	4,724 820	Direct Administration	1930
Contract No. 5	Treboeth and Trewyddfa	8,834	Hussey, Egan and Pickmere, Birmingham	1928—1929
***Work No. 6** ***Work No. 6A**	Fforestfach and Waunarlwydd	12,169 8,145	Mainly by Direct Administration	1930—1931

*Drained to Loughor Estuary.

SUBSIDIARY SEWERS—continued.

PART II.—SUBSIDIARY SEWERS (for locations see Key Map).

	District.	*Length of Sewers*	*Contractor.*	*Date.*
		Yards		
***Work No. 6B**	Sewerage Works at Gowerton	1,907	Direct Administration	1933—1934
Work No. 7	Gorse Road	1,775	Direct Administration	1930—1931
Contract No. 10	Langland & Newton and Sketty to Brynmill	6,417	South Wales Contractors Ltd., Penllergaer	1935—1936
Contract No. 11	Clyne Valley, Killay, Dunvant and Derwen Fawr	12,108	Sir William Prescott & Sons Ltd., London	1934—1936
Contract No. 13	Clydach & Bwllfa and Wychtree Street	1,968	H. Smith, Newport	1935—1936
Contract No. 14	Port Tennant, St. Thomas and Old Guildhall Areas, including Burlais Brook Reconstruction	4,111	Kinnear, Moodie and Co., London	1936
———	Carmarthen Road, Fforestfach	1,330	Direct Administration	1924
———	Midland Terrace, Morriston	353	Direct Administration	1927—1928
———	Cockett Road	368	Direct Administration	1930

*Drained to Loughor Estuary.

Wellcome Library

PRINCIPAL SUB-CONTRACTORS AND SUPPLIERS.

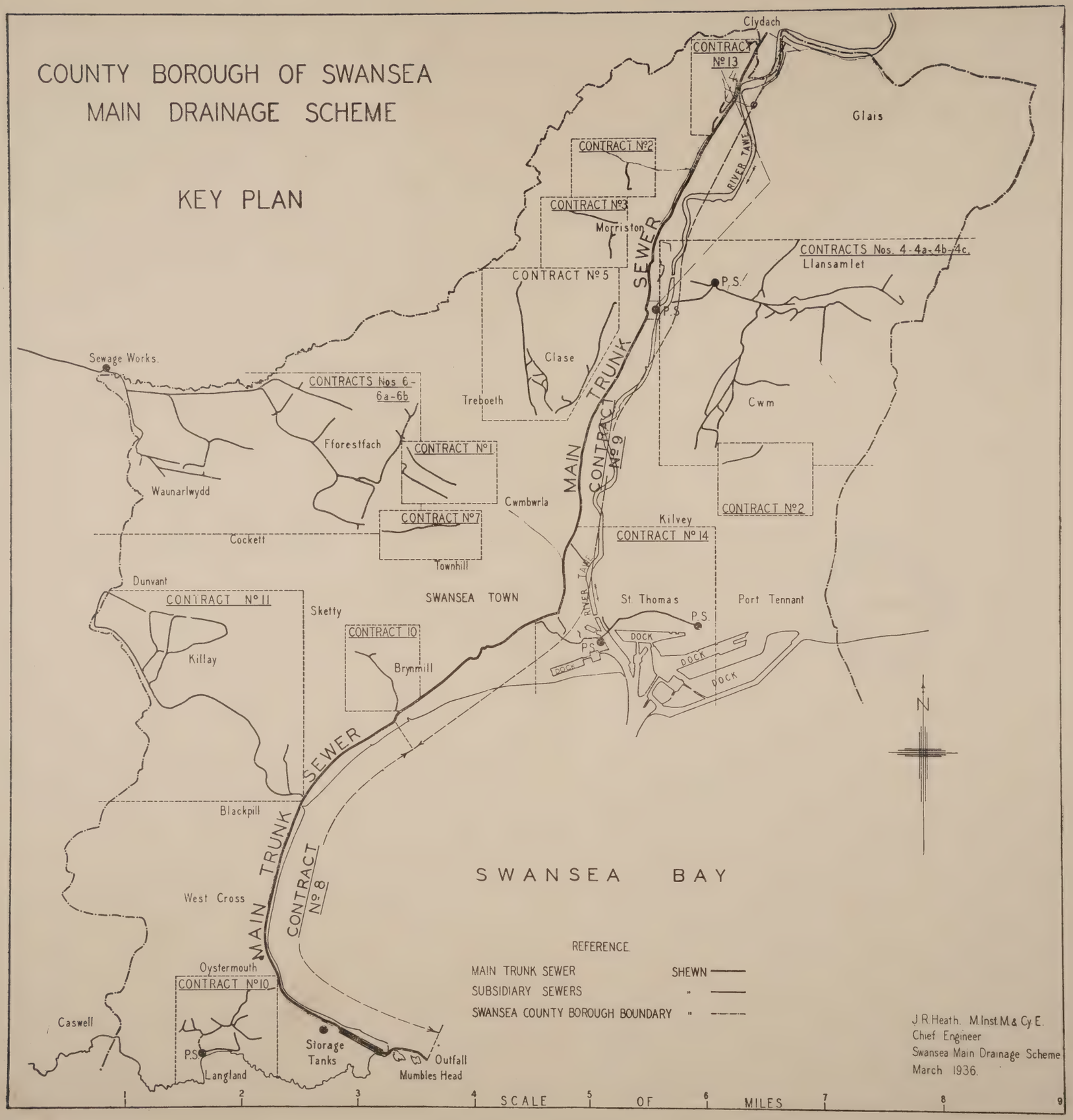
SUB-CONTRACTORS.

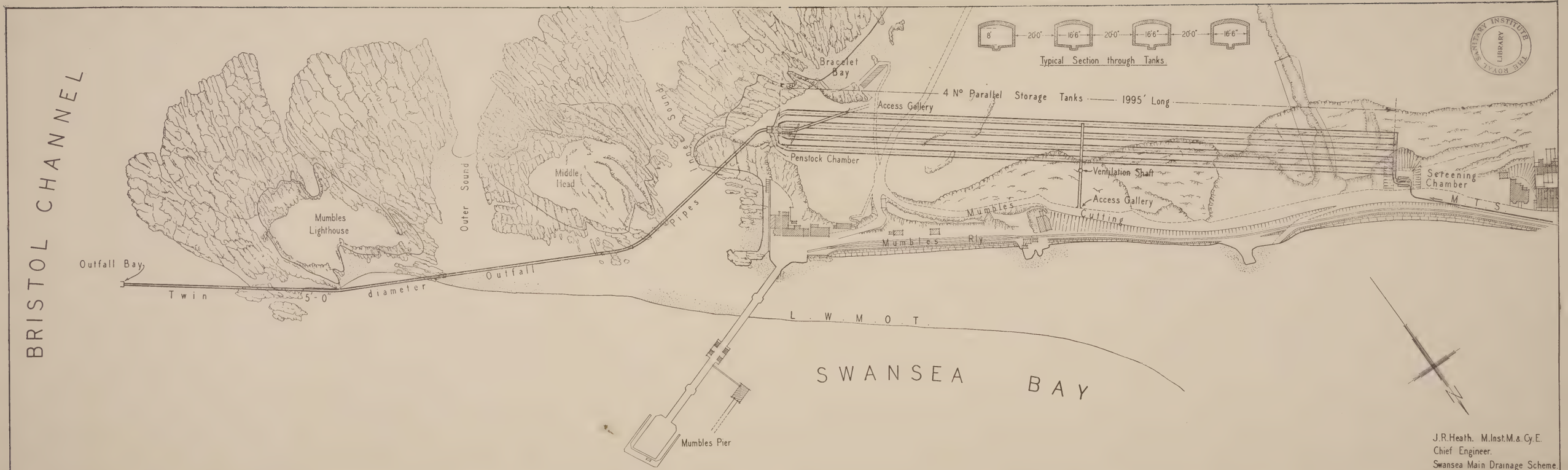
Equipment at Screening House, and Storage Tanks—	
Power and hand operated penstocks, flap valves, screening and raking machines, grit elevator, automatic flow balancing gear	Blakeborough & Sons Ltd.
Disintegrating pumps	Pulsometer Engineering Co. Ltd.
Lifting gear	Herbert Morris Ltd.
Ventilating fan	Waddle Patent Fan & Engineering Co.
Float recorder	George Kent Ltd.
Electric wiring	Colston Electrical Co. Ltd.
Attendant's house	Swansea Corporation (Borough Architect's Department).
Structural Steelwork	A. D. Dawnay & Sons Ltd.
Penstocks and Sluice Valves	Heywood and Porteus Ltd. Adams Hydraulics Ltd. Ham, Baker and Co. Ltd. Guest and Chrimes Ltd. Blakeborough and Sons Ltd.
Iron frame windows	Henry Hope and Sons Ltd. Crittal Manufacturing Co. Ltd.
Sewage pumps	Pulsometer Engineering Co. Ltd. Blackstone and Co. Ltd.
Storm-water pumps	Pulsometer Engineering Co. Ltd.
Flow Recorders	George Kent Ltd. Lea Recorder Co. Ltd.
Flow Control valves	Glenfield and Kennedy Ltd.
Electric wiring	Swansea Corporation (Borough Electricity Department).
Iron hatchway covers	Rees and Kirby Ltd.
Wrought iron railings	W. A. Baker & Co. (1910) Ltd.
Power operated grit dredger and automatic screens	S. S. Stott and Co.
Travelling gantry and crane	Vaughan Crane Co.
Iron gratings	Swansea Corporation (Highways Dept., Smith's Shop).

SUPPLIERS.

Engineering bricks	The Accrington Brick and Tile Co. Edward Oakland and Co. Ltd. Graig Brick and Tile Co.
Cement	South Wales Portland Cement Co. Sessions and Sons. Ltd. J. & W. Henderson Ltd.
Sand	The South Wales Sand and Gravel Co. T. H. Harris.
Crushed stone	Cwmrhydyceirw Quarry Co., Ltd. Barland Quarry Co.
Lime	Aberthaw and Bristol Channel Portland Cement Co. Ltd.
Glazed stoneware pipes	Swansea Potteries Ltd. Thomas Wragg and Sons. Gwent Pipe & Fire-brick Co. Ltd.
Cast iron pipes	Stanton Ironworks Co. Ltd. Staveley Coal & Iron Co. Ltd. Baldwins Ltd.
Concrete pipes	Stanton Ironworks Co. Ltd.
Cast iron tunnel segments	Head Wrightson and Co. Ltd. United Steel Co. Robert Potter and Sons.
Tunnel shields	Markham and Co. Ltd. Sir William Arrol and Co. Ltd.
Steel bars	Whitehead Iron and Steel Co. Guest, Keen and Nettlefolds Ltd.
Pneumatic tools	The Consolidated Pneumatic Co. Ltd.
Timber	Gregor Bros. Ltd. Robinson, David and Co.
Photographs of the Works	Photo Supplies Ltd.

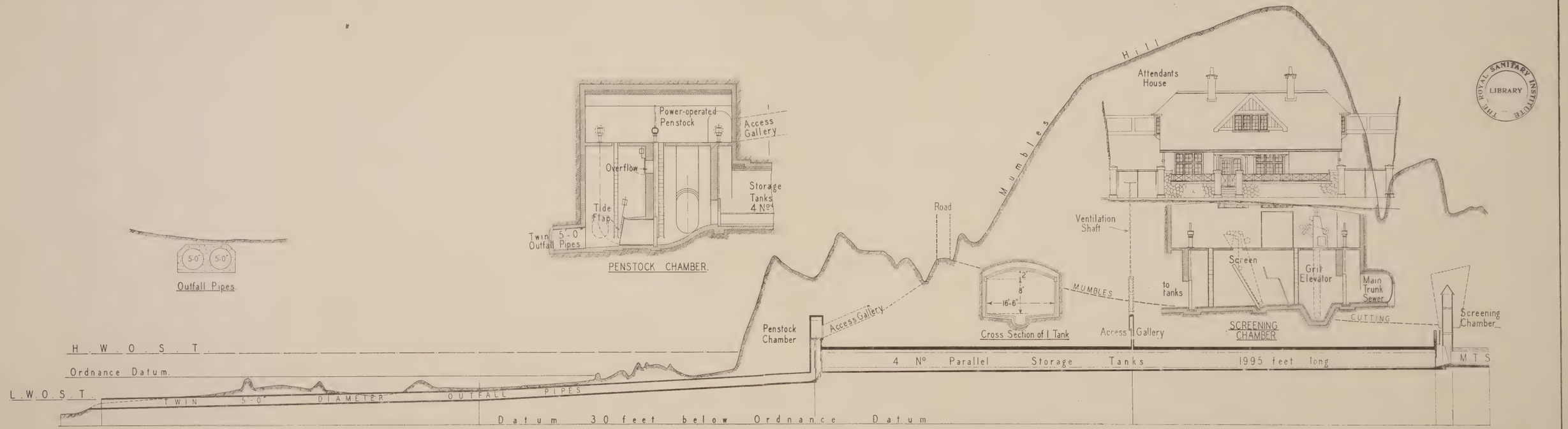
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